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THE

Manual of Commerce,

CONTAINING A CONCISE ACCOUNT OF THE SOURCE, MODE OF PRODUCTION OR MANUFACTURE OF THE

Principal Articles of Commerce.

DESIGNED FOR THE USE OF SCHOOLS AND FAMILIES,

BY

S. H. BROWNE.

PUBLISHED BY
BILL, NICHOLS & CO., SPRINGFIELD, MASS.
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PREFACE.

THE object of this MANUAL is to afford information in regard to the principal articles of Commerce. It embraces a short account of the most interesting productions of the Animal, Vegetable, and Mineral Kingdoms. It also exhibits the uses to which they have been converted through the agencies of Science, the Arts, or Manufacturers. The book is designed especially for *Schools*. It is intended to serve as a convenient volume of reference for the teacher's desk, furnishing appropriate matter for oral instruction and object lessons; and also as a text-book for classes. It contains a vast variety of topics, with much useful information under them, brought down, as nearly as possible, to the present date. It professes to offer, in a condensed and convenient form, what no other single book for schools can do, or has ever done. The need of such a volume, both for teacher and pupil, has long been felt and acknowledged; and it is hoped that the present work will fully supply that need. For the later terms in Grammar Schools, the earlier in High and Normal Schools, and for general use in Private Schools and Academies, it is eminently adapted, in matter and arrange-

ment. The MANUAL OF COMMERCE is therefore earnestly commended to the public as a most desirable addition to the list of useful and popular school books. The author believes that those who are entrusted with the responsibility of directing the studies of the young will at once recognize its value.

SPRINGFIELD, *August*, 1871.

S. H. B.

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CHAPTER I.

COMMERCIAL ARTICLES OF FOOD, VEGETABLE AND ANIMAL.

AMONG the innumerable materials which man has appropriated to his own service in various ways, those occupy the most important place which furnish him with necessary FOOD. He can exist without any of the conveniencies, elegancies, or luxuries, with which he surrounds himself in civilized and refined communities. He can even live without clothing, in a favorable climate, but if his supply of *food* is cut off for only a very short time, he inevitably languishes and dies.

The subject of FOOD then, under its natural division into vegetable and animal substances, properly stands at the head of our catalogue of commercial articles.

Variety and means of obtaining food.

These substances are of vast variety and of world-wide distribution. They embrace the products of every climate; they are scattered over every land and sea; and the skill and ingenuity of man must convert them to their legitimate use. For some, he must carefully till the soil, and patiently await the harvest; while others require only to be gathered in their season as the lavish bounty of nature. He must cast his line or net into the

waters; he must pursue, or snare, or slaughter the animal which he values for its flesh.

In this manner he must supply his need with his own hands, contenting himself with what will suffice for his subsistence, as in savage or barbarous conditions of society; or he must enlist the agencies and activities of commerce to bring from every clime and country, that superfluity and variety, which a more advanced state of civilization has rendered desirable if not absolutely necessary.

VEGETABLE FOOD.

SECTION I.—GRAINS, Etc.

RICE.

Of all the vegetable substances used as food by man there is no one that sustains so great a number of human beings as *Rice;* and if an article of food is important in proportion to the population dependent upon it, none will question that this grain should be placed first in our list, as it furnishes the principal support of at least one-third of the human family. Some of the most densely-peopled countries on the globe, rely mainly upon it, to feed their swarming millions; so that its commercial value can not well be overestimated.

Rice and its mode of cultivation.

Rice resembles wheat in its size, color and manner of growth. The stem reaches a height of about

three feet, but unlike wheat it requires a low, moist soil, thriving upon lands too wet to produce any other valuable plant. Although cultivated to a great extent within the tropics, it flourishes well beyond them, even producing a larger kernel.

The details of the process of cultivation vary with the climate and people, but warmth and abundant moisture are everywhere indispensable to perfection of the crops. The ground is carefully leveled and prepared in such a manner that it can be overflowed with water after the seed is sown. As the grain grows and ripens, the water dries away and leaves the ground ready for the harvest. In the East it is reaped with the sickle; and, as no new modes of husbandry are ever introduced there, the sheaves are carried from the field on frames of bamboo borne on the shoulders of men. The grain is separated from the straw by threshing, or beating, or the treading of cattle driven over it for the purpose. It is cleared from the husk by pounding or grinding between two flat stones kept so far apart as not to crack the grain. The kernel is beautifully white when thus separated, and in cooking swells to twice or three times its size when dry. Before the husk has been removed it is called *paddy*. A great deal of rice is imported in this unshelled state, and cleaned in Europe or this country.

Rice growing regions of the East.

China, India, and indeed all the warm countries of Asia and Africa produce rice in immense quantities; and the surplus, after supplying the teeming population of these regions, is sent to all other parts of the world.

Recent travelers in India and the adjacent islands give us some interesting particulars of this branch of agriculture as it is there carried on.

Some details of the rice culture in India.

The aspect of the lowland rice-field, they say, is very different at various seasons of the year. In Java, for instance, where you see to-day long-legged herons stalking over an inundated plain partitioned by small dykes, or buffaloes wading through the mud, you will, three or four months later, be charmed by the view of a green and waving rice-field which rarely disappoints the hopes of the husbandman. He watches it from day to day, driving from it the flocks of sparrows and rice-birds which prey upon the forming grain, with ingenious devices of cords and *scarecrows*, which traverse the field in every direction. When the waters are wholly evaporated, and the harvest is ripe, it is a time of general rejoicing, for all the villagers, old and young, busy themselves in reaping and securing the precious grain.

After the harvest, the field, especially in the mountain region, (where this grain is also cultivated by an artificial system of irrigation,) is sown a second time with some other crops; it is then allowed to lie fallow for a few years, and is soon covered with a rank vegetation. When cultivated next, it is burnt over, and the ashes afford the richest fertilization for the next crop.

Rice is said to have been brought to the West Indies by Columbus, in 1493. In 1697 its culture was introduced into South Carolina, and since

then it has been greatly extended along the south-eastern and Gulf coasts of the United States, and has proved a most valuable addition to the grain products of the country, the kernel being finer and larger than that grown in the East. Introduction and cultivation in the United States.

The mode by which this valuable grain was first introduced into our Southern States was the following: A vessel from the island of Madagascar, about the beginning of the last century, happened to put in at Charleston, S. C. Having a little seed-rice the captain gave it to a gentleman by the name of Woodward. From a part of this seed a crop was raised, and distributed among neighboring planters. Thus it found its way to the whole neighborhood; and ultimately changed into fruitful fields, the swamps and bogs of the whole coast which had hitherto been worthless; not merely supplying the United States with all the rice they require, but annually exporting immense quantities to the various markets of Europe.

As an article of diet, rice is agreeable and highly nutritious. Its use is almost universal, and its various modes of preparation for the table are too well known to need description. It is often ground into flour and thus enters into many culinary compounds. The native country of the grain was probably in southern Asia, whence it has spread not only over the whole tropical world but far beyond; for it thrives alike wherever its conditions of growth are observed, requiring a bountiful supply of water in its early stages. Native country of rice.

A species of wild rice grows in some of the inland parts of America which is valued by the new settlers, and was formerly an important article of food among the Indians.

Wild rice.

WHEAT.

Wheat may properly stand second in the list of food plants, on account of its extensive cultivation and almost universal use. Its native place is not certainly known, but it is supposed to have originated in Tartary or Persia. As it is adapted to a temperate climate, its area of cultivation is very wide in both hemispheres. Immense quantities are raised in Europe particularly in Russia, and thence exported to other countries. Dantzic, near the mouth of the Vistula, is one of the principal ports in Europe for the trade in wheat.

Wheat.

All the grains of the old world have been introduced into the new. The first wheat sown in North America is said to have been a few kernels accidentally discovered in a quantity of rice brought over for the support of the army of Cortez. Its culture now extends over vast tracts of country between the Atlantic and Pacific, furnishing to commerce an inexhaustible supply; and as its area of growth annually extends with the settlement of the country, it is probable that at no distant day our great country will become the granary of the world.

Introduction into America.

Wheat is generally sold by the producer to those who convert it by grinding and bolting, into

flour, in which form it is sent in barrels and sacks to all markets of the earth. Different qualities of flour command different prices.

MAIZE OR INDIAN CORN.

This most valuable grain is no less important to the rapidly increasing population of America than the rice-plant to the inhabitants of India; and when in future years the banks of our great rivers, the Mississippi, Missouri, Amazon and Orinoco, shall be as densely populated as the plains of India, perhaps the number of maize eaters will exceed those who now live mainly upon rice.

Importance of this grain.

It is a plant of the new world and was called *mahiz* or *mahis* in the language of the natives; but the Spaniards gave it the name of *Indian Corn*, being first found among those whom they erroneously supposed to be inhabitants of India. It made a very important article of their simple diet, and though their mode of cultivation was exceedingly rude, the genial climate favored its growth and perfection with little labor. They ate it green or boiled, parched or bruised in mortars of stone.

Use by the Indians.

Columbus exhibited specimens of it to Ferdinand and Isabella when he returned to Spain laden with the productions and wonders of a new country. He did not know, neither did his royal patrons, that the spikes (or ears, as we call them) of maize, were in reality of far

Introduction into Europe.

greater importance than the gold and silver which were then considered the richest trophies of his great discovery.

From Spain, where it was first seen in Europe, the cultivation of maize extended over the tropical and temperate portions of the eastern hemisphere; and it is at present one of the most valuable articles of human subsistence. It is planted in hills and requires considerable labor in preparing the soil and keeping it free from weeds; but it is a crop that generally rewards the industry of the planter.

This noble cereal is too well known to need particular description; its mode of culture, its elegant appearance in the field, its great productiveness (especially in warm regions) and its innumerable uses for man and beast, are entirely familiar to every one. It may truly be styled the King of Grains; and is one of the most important of all the articles of commerce.

Growth, varieties and uses.

There are several varieties of maize, differing chiefly in the size and shape of the kernel; such as the common yellow corn, southern or white corn, sweet corn, pop corn, rice corn, etc.

The meal is used for bread, for feeding and fattening animals, and for many other purposes. Enormous quantities of maize are annually produced in the Northern and Western States, and sent to the southern parts of the country and to foreign markets.

RYE, OATS AND BARLEY.

These grains will grow in a higher latitude than wheat. They were once staples of food for the com-

mon people in the northern parts of Europe, and are still used to a considerable extent where wheat can not be cultivated. But it has superseded them in many places where it was formerly believed this valuable grain would not flourish; so that they are less and less depended on, except as food for domestic animals. Reduced to a state of malt, barley forms one of the principal ingredients in beer, ale and kindred liquors.

Rye, oats and barley.

BUCKWHEAT.

This is a kind of grain which grows in temperate climates but is of less importance than most others. The kernel is triangular, and the flour of a dark color. It is used extensively in this country in making "griddle-cakes" to be eaten hot for breakfast. It is also considered a valuable food for fowls.

Buckwheat.

PEARL BARLEY.

This is the small round kernel of the common barley, which remains after the skin and part of the grain have been ground off by passing it between mill stones of a peculiar kind. The kernels are first steamed and then dried to soften the skin, in order that it may be more easily removed.

Pearl barley.

ARTICLES OF FOOD DERIVED OR MANUFACTURED FROM GRAIN.

There are some articles obtained from various grains by mechanical or chemical processes, which

form branches of commerce more or less important.

Hominy.

Hominy is the kernel of maize slightly broken or very coarsely ground. It is boiled till soft and makes a very nutritious and palatable dish.

Wheat grits, or *cracked wheat*, is the kernel of wheat prepared in a similar manner.

Corn starch and Farina.

Corn starch and *Farina* are obtained by washing the flour of corn or wheat, and separating from it the starchy substance, which is used in many forms of cookery. The starch for stiffening linen is procured much in the same way.

Macaroni and vermicelli.

Macaroni is a kind of wheaten paste formed into long slender tubes, by passing it through holes so contrived that it takes this form. It is of several sizes, the largest being called *macaroni*, the next *vermicelli*, and the smallest *fedelini*. The best is prepared at Naples. It is generally used as a nutritious ingredient of soups. The Italians are very fond of it, and it forms a constant article of diet with them.

POTATOES.

Native country of the potato.

The common potato is a native of the New World, probably of South America, as it still exists in Peru and Chili in a wild state. Some writers however maintain that it was first found in Virginia, as it was introduced into Europe from that region. It is now culti-

vated in nearly every part of the civilized world, and is justly regarded as one of the most valuable food plants on the globe.

The principal kinds are the *common* or *Irish potato*, as it is sometimes called, and the *sweet* or *Carolina potato*, also called the Spanish potato. The first is much the most important and widely distributed, as it will grow in almost any climate though it matures best in the temperate zones. The sweet or Carolina potato is botanically, an entirely different plant from the other, and requires a much milder climate. Its native country is the Malayan peninsula, whence it has found its way to other warm regions of the earth. It is extensively cultivated in the south of Europe, and the middle and southern portions of the United States. The common potato has been wonderfully improved by cultivation and there are many varieties, some of which produce a larger and surer crop than others. Considerable quantities are exported from the Northern to the Southern States, and to foreign countries. Many thousand bushels are also annually converted into starch.

Two kinds of potato.

Common potato.

In Ireland the potato crop is so important that its failure has been the cause of great suffering and sometimes of frightful famine.

Importance of the crop.

The modes of cultivation and use of the common potato are too well known to need description.

The *sweet potato* is an herbaceous perennial plant which sends out many trailing stalks extending six or eight feet in different directions, and putting forth

at each joint, roots which in a favorable climate grow to be very large tubers; so that from one plant forty or fifty large roots are produced. The leaves are angular, standing on long stems; the flowers are purple. The sweet potato is propagated by laying down the young shoots in the spring; indeed, in its native climate it multiplies almost spontaneously; for if the branches of roots that have been pulled up are suffered to remain on the ground, and a shower of rain falls soon after, they will at once begin to grow again.

Sweet potato.

Although the plant is so prolific in a tropical climate, yet in Brazil it is raised more as a luxury for the planter's table than as an article of food for the negroes who till the soil.

The Southern and Middle United States furnish a supply for those portions where it does not thrive well. It is only used when first grown, as it does not keep in store like the common potato.

YAMS.

The *Yam* roots are also a product of tropical, or quite warm regions. They are cultivated much like the common potato, which they resemble in taste, though of a finer texture. There are two varieties, growing from climbing plants, with tender stems from eighteen to twenty feet in length having smooth sharp-pointed leaves on long foots-talks, from the base of which arise spikes of small flowers. The roots of one kind are flat and spread out like fin-

Two kinds of Yams.

gers, about a foot in length, white within, and externally of a dark brown color approaching black. Those of the other kind are still larger, being frequently three feet long and weighing thirty pounds. When dug from the earth the roots are placed in the sun to dry, and are then put into sand or casks, where, if kept from moisture, they may be preserved for a considerable time. The yam is a native of southern Asia, and is supposed to have been transplanted to the West Indies, as it has never been found growing wild in any part of America; while in the island of Ceylon, and on the coast of Malabar, it flourishes spontaneously in the woods. Yams are now very extensively cultivated in Africa, Asia, and America, as their large nutritious roots amply reward the labor required to raise them.

OTHER ESCULENT VEGETABLES.

Although there is no other root which compares with the potato in importance, there are many others which furnish a lively trade at certain seasons, between the warmer and colder parts of the country; the warmer sending its earlier ripe vegetables and fruits to the colder in advance of its own. Aside from tropical productions, of which we do not now speak, the beet, radish, onion, cucumber, asparagus, tomato, cauliflower, etc., etc., might be named.

Peas and *beans*, shelled and dried, are also much used for ship and army stores, besides their consumption in families, to some extent, either in the green or dry state. Other vegetables not tropical.

SAGO.

Sago Palm.

This is the product of a palm called the Sago Palm, which grows in the East India islands, China, Japan, the Moluccas, etc. It attains the hight of thirty or forty feet, and is surmounted by a beautiful crown of foliage consisting of long drooping leaves, from the base of which rises the flower stem. It flourishes best in low and moist situations. The fruit is a nut which is of no value; the only eatable part being the pith which is contained in the trunk of the tree. Before reaching its maturity the stem consists of a woody shell usually about an inch thick, filled with an enormous quantity of spongy pith penetrated with long fibres in a kind of net-work, which is filled up with this powdery substance, almost like meal.

Mode of obtaining the Sago.

After the tree has borne fruit, this substance is gradually absorbed and the trunk ultimately becomes hollow. But at the right period, which is just before flowering, the tree is cut down and divided into lengths of five or six feet. These are split and the contents carefully scraped out after being reduced to a coarse powder by pounding with a heavy wooden club. The meal is soaked and washed in water to clear it from the fibrous and woody matter which may adhere. It is strained into vessels where the meal settles to the bottom, and the water being drained off, it dries into a kind of paste. This is called raw sago and may be eaten at once or

made into cakes and baked to dryness. In this form much is sold and consumed by the natives.

The sago of commerce is prepared by moistening the raw sago and passing it through a sieve over a moderate heat. The grains are thus partially baked, and will keep a long time if protected from the air. Preparation of sago.

If the raw sago is boiled, it forms a thick glutinous mass which is eaten by the natives of the Malayan Archipelago, with salt, limes, or peppers. But more frequently it is used for making bread. The raw sago is broken up and beaten into meal. "The oven is a square clay pan," says Mr. Wallace, a late traveller in that quarter of the world, "divided into compartments six or eight inches square, and three quarters of an inch deep. This is heated over a clear fire of embers, and then filled with the flour and covered with a piece of sago bark. In five minutes the cakes are baked, which fill the squares of the pan. When hot they are very palatable, eaten with butter; and with the addition of a little sugar or grated cocoanut, form quite a delicacy. They are soft and not unlike our 'Johnny cakes' made of Indian corn meal. When not wanted for immediate use the cakes are dried in the sun for several days; they will then keep for years. Dipped in water and toasted, they are almost as good as when fresh; soaked and boiled, they make a good pudding. There is no reason why these sago biscuits should not form an article of foreign commerce, and furnish a valuable addition to ship Sago bread or biscuit.

stores, especially in tropical regions where it is difficult to preserve food for any length of time."

A good sized sago palm will afford eight or nine hundred pounds of raw sago.

Pearl sago is a refined quality which has a pearly lustre and is in small and even grains. This is the kind generally used. Common sago has larger and more unequal grains. Sago meal is sometimes imported, but it is not much used in this form.

Pearl and common sago.

TAPIOCA.

This substance comes from the root of a plant which is a native of Brazil in South America, though it is cultivated largely in the West Indies. In Brazil it is called mandioca or tapioca; in the West Indies, cassava —the only difference consisting in the size of the grains—the cassava being the finest.

Native country of the mandioc.

The mandioc is a shrub about six or eight feet in hight, with a round jointed stem and deep green leaves. It has a very large, white, fleshy root which often weighs thirty pounds. The plant grows quickly, and the root arrives at perfection in about eight months. There are two varieties, the sweet and bitter. The root of the sweet is wholesome and may be eaten with impunity; but the bitter abounds in an acrid milky juice, which is poisonous if eaten fresh. Both however are used to produce the tapioca of commerce. It is prepared by washing, scraping and grinding

The shrub described.

the root into pulp, which is then subjected to pressure to separate the poisonous juice. What remains is of a mealy consistence, and is ready to be made into bread, cakes, or puddings. What we know by the name of tapioca is obtained from the juice. By standing it deposits a powder which after repeated washings in cold water, is nearly pure starch. It is dried by exposure to heat, which makes it assume that semi-transparent appearance we notice in cooking. When dried in the sun it is mealy and resembles arrow root. It is nutritious food (all the poisonous qualities being expelled by heat) and is much used for puddings. It comes to us in the form of coarse irregular grains.

Mode of preparation.

ICELAND MOSS.

This is a kind of lichen which is found in the northern latitudes of both continents. It received its name from the great quantity produced in Iceland. It is also abundant on the higher slopes and sandy plains of the Northern United States. It grows two or three inches high, is of a brownish green color, lighter on the under, than the upper surface. It is dried, and its bitterness afterwards extracted by repeated washings in water. It contains gum, starch, and other nutritious principles, and is a very important article of food in the high latitudes of Europe and Asia. Ground and made into bread, or dissolved in boiling milk or water, it is a wholesome food, and is often used as a diet for the sick.

Iceland moss.

ARROW ROOT.

Arrow root is a starchy substance obtained from the fleshy root of two different plants; one a native of the West Indies and the other of South America. It reaches a hight of two or three feet and is propagated by parting the roots. It has broad, pointed leaves, and from the top rises a spike of small white flowers. The roots are dug when a year old, and beaten in a large wooden mortar, after which the pulp is thrown into water where the starch is separated from the fibres and collects at the bottom of the vessel in which it is washed. It is then dried in the sun. It makes a light nourishing food.

SECTION II.—FRUITS.

THE fruits of the earth likewise minister largely to the sustenance of mankind. Although many may be ranked among the luxuries, rather than the necessaries of life, and some may be considered as luxuries in one section while they are necessaries in another, yet as a whole, they occupy a very important place, and furnish a great many valuable articles of commerce.

In tropical countries, a *vegetable* is generally preferred to an *animal* diet, and here we find the nutritious and luscious fruits in the greatest abundance and perfection; growing spontaneously, or culti-

vated with little labor. Commerce, however, exchanges the productions of one zone for those of another, and thus the bounties of nature are shared by all. Science, too, lends her aid, and by the process of *canning*, so recently brought into common use, not only adds to the resources of trade, but furnishes those palatable and delicious articles in a fresh state to every clime and country, at all seasons of the year.

Diet in Tropical countries.

Canned fruits.

APPLES.

The fruits of temperate regions are not generally depended on as staples of food, although they furnish many of its most agreeable diversities.

Apples are perhaps the most abundant and widely distributed, as they are very hardy and of rapid growth.

The apple, like most of our fruit trees, was introduced into this country from Europe; and it is supposed that the numerous and fine varieties have sprung from the original crab-apple of Europe.

The apple.

Great care is taken at the present day to improve the size and flavor of the apple and it has become an important article of export from this country. The inferior qualities are made into cider by grinding and pressing, much of which is converted afterwards into vinegar. Apples are also dried, and in this form are thrown into market in large quantities.

PEARS.

Pears.

Pears are much more common than formerly, and are now produced in great variety. Many are grown on dwarf trees which afford fruit very early. Ground and pressed, they furnish a liquor called *perry*.

PEACHES.

Peaches.

The native country of the *peach* is supposed to be Persia, but it was brought to this country from Europe; and nowhere does it attain greater perfection in regard to the character of its fruit than in the United States. Besides being canned for use, fresh peaches are dried like apples. The kernels of the fruit resemble bitter almonds. A liquor has been distilled from the peach called peach brandy.

PRUNES OR PLUMS.

Plums or prunes

The common *prune* or *plum* is well known to all. It was originally brought from Asia to Europe and from Europe to this country. There are numerous varieties. The prunes of commerce, which are dried plums, are brought chiefly from the south of France; the best from Bordeaux. They are prepared by drying in the sun, after having been exposed to the heat of an oven.

ALMONDS.

Almonds are the fruit of a tree which resembles the peach in its foliage and flowers. It is a native

of Persia, Syria and Barbary, and is very extensively cultivated in the south of Europe. It has been introduced into the United States, but in the northern and middle sections the fruit does not come to perfection. The tree grows usually from fifteen to twenty feet high, and divides into numerous spreading branches. The flowers are large, of a pale red color varying to white. The fruit is of the peach kind, with the outer covering thin, tough and dry, which opens when fully ripe. Within this covering is a rough shell, which contains the kernel or almond. The two principal varieties are the sweet or Jordan almonds, which are imported from Malaga, and the bitter, which are obtained chiefly from Morocco, and are exported from Mogadore. They come in casks and boxes, and are used in cookery and in medicine. When the brown coating of the kernel has been removed they are called *blanched almonds*. This is done by immersing them in boiling water.

Almonds, tree and fruit.

Sweet and bitter almonds.

DATES.

Dates are the fruit of a palm-tree which abounds in Egypt, Barbary, Arabia, Persia and other neighboring countries. It is a tall majestic tree, and highly regarded in the East both for its beauty and utility. It reaches the hight of sixty feet having a rugged trunk terminated with a tuft of leaves six or eight feet long. The flowers come out in large bunches from the

The date-palm.

trunk between the leaves, and produce a cluster of oval berries with a thick sweet pulp, and enclosing a hard oblong stone, which has a furrow on one side. When quite ripe these berries are soft and of a red color. They are gathered and formed into a hard mass or cake, by pressing them into large baskets containing about two hundred pounds. In this form the fruit is exported. In retail trade it is cut out of the baskets and sold by the pound.

Prepared for market.

Dates form a considerable part of the food of the people where they grow plentifully, and the harvest is looked for with anxiety, and welcomed with general rejoicing. Its failure causes apprehensions of famine. Between the Atlas range of mountains and the Great Desert, the date-palm grows in such abundance that the Arabs have named the country "*Beled el jerid*," the *Land of Dates*. One tree will yield from one hundred to three hundred pounds in a season.

Importance of the date-palm and its abundance.

Besides its value as a food plant, the date tree supplies many other needs of the inhabitants. From the leaves are made baskets, bags, mats, brushes, etc., their stems serving to construct poultry cages and other rough articles. The trunk is used for timber; the fibrous mass at the base of the leaves, is twisted into cordage, and employed in rigging small vessels. The pith of the trunk is eatable, as are also the buds and young shoots. From the sap is distilled a kind of spirituous liquor called *arrack;* and finally

Many uses of the date tree.

the hard stones of the fruit are soaked and ground up as food for camels, cows, and sheep.

FIGS.

The *fig-tree* flourishes in all the countries that border upon the Mediterranean Sea, particularly in Italy and France. It has been introduced into other places where the climate is sufficiently mild. The southern United States produce very fine fruit, though not yet an article of export. The tree ordinarily grows from twelve to fifteen feet high, though it sometimes reaches twenty-five or thirty. The fruit grows from the angles of the leaves without any visible flowers; these being *inside* the receptacle, the walls of which become thick and fleshy, and constitute what is commonly called the fruit; though strictly speaking this term is applicable only to the small seeds found in great numbers on the interior surface, to which they are attached by minute fleshy stems. When ripe it is soft and sweet; of a whitish yellow or purple color. Cultivation has produced in the fig as in other fruits, many varieties in shape, size, color, and taste.

The fig-tree and its fruit.

Some of the most enormous trees of the tropical world are fig-trees; such as the sycamore of Egypt whose trunk in the course of centuries swells to a colossal size, though it does not grow more than forty or fifty feet high. Its vast crown of foliage covers a large space of ground with a dense and delightful shade. Its

Egyptian sycamore.

figs have an excellent flavor, and its wood is nearly incorruptible. Most of the mummy coffins are made of it.

The stately banyan of India, too, is a fig-tree—each one, rather, a grove in itself. Some of them are already of astonishing size and continually increasing by throwing out new branches which strike down to the earth, root, and then become parent trees themselves, by swelling into trunks and sending forth other branches.

The banyan.

*"The Hindoos," says Hartwig, "are peculiarly fond of this tree; they consider its long duration, its outstretching arms, and overshadowing beneficence as emblems of the Deity. They plant it near their temples; and in those villages where there is no temple for worship, they place an image under a banyan, and there perform their sacrifices.

Regard of the Hindoos for the banyan.

"Many of those immense fig-trees are celebrated in history and are of unknown age. The famous '*Cubbeer-burr*' (named from a Hindoo saint,) is supposed to be the same as that described by Nearchus, a general of Alexander the Great. Portions of the tree have been washed away from time to time by floods of the Nerbuddah river, near which it stands, but what remains is nearly 2,000 feet in circumference measuring round the principal stems, while the overhanging branches not yet struck down cover a much larger space. In the march of an army it has been known to shelter 7,000 men."

The Cubbeer-burr.

* Hartwig's Tropical World.

The figs of commerce come chiefly from Smyrna and Turkey. After being dried by the heat of the sun or in ovens, they are packed in small drums or boxes, so firmly as to flatten the fruit. Figs of commerce.

GRAPES.

The grape, which is supposed to have been derived originally from Asia, is now spread over all the temperate regions of the civilized world. Its fruit is exceedingly influenced by soil and climate, and the varieties which have resulted from culture and situation are innumerable. Diffusion of the grapes.

The finest grapes are imported from Malaga in Spain, and some parts of Portugal, France, and Italy. The white grapes come in large jars or boxes secured from damage by means of dry sawdust. In this country grapes of fine flavor are raised, and the cultivation of the vine is rapidly extending. Malaga grapes.

When grapes are dried and preserved they are called *raisins*. The best are also brought from Malaga. They are of a purplish brown color, and a delicious taste. They are prepared by partially cutting the stems of the bunches, and allowing them to dry upon the vine. Sometimes two or three of the neighboring clusters are tied together and dipped into a weak alkaline solution, the effect of which is to shrivel slightly, and harden the skin. In a few days they are cut off and dried in the sun. Malaga raisins.

The cheaper and more ordinary qualities are dried in ovens. Packed in boxes and casks, in this form they are thrown into market. They are used for the table, and in various sorts of cookery.

Packing and use.

Currants are a small species of dried grape cultivated in and imported from the Levant. They are used in cookery like raisins.

ORANGES.

The *orange* is a native of China and India, but was early introduced into Europe, and transplanted to America soon after its discovery. It is now found in every country where the climate will admit of its cultivation. This beautiful tree whose fruit and foliage are mingled with its blossoms, grows about fifteen feet high. The stem is covered with a smooth shining greenish-brown bark. The leaves are of a brilliant glossy green, and when held between the eye and the light, exhibit numerous transparent points, which are minute vessels containing a fragrant oil. The flowers are large, white, and of a delightful odor. The fruit is spherical, somewhat flattened, of a yellow or *orange* color, and too well known to need description.

The orange tree.

Flowers and fruit.

The orange flourishes in the southern part of our country, especially in Florida. In the West Indies they grow to perfection, and large quantities are exported from Havana and other West Indian ports,

as well as from the south of Europe. An essential oil is derived from the peel, particularly of the *Bergamot orange*, much used in perfumery. The leaves and flowers are also used in medicine. The fruit is gathered before it is fully ripe and packed in boxes for transportation.

Bergamot orange.

CITRONS, LEMONS AND LIMES.

The *citron*, *lemon*, and *lime*, are kindred fruits, and like the orange are natives of Asia, having also been scattered over the civilized world. Even where the climate is too severe to permit their exposure in the open air during winter, they are often ripened in hot-houses by artificial heat. We are supplied with these fruits principally from the West Indies and the regions bordering on the Mediterranean.

The *citron* is the largest of the three, being sometimes six inches in length, of an oval form and a yellowish color, with a very rough, thick and spongy rind. In the interior it is divided into cells containing an acid juice precisely like that of the lemon. The rind is used in making conserves.

The citron.

The *lemon* is smaller than the preceding, oblong in shape, with a pointed tip on the summit. It has a smoother coat, a brighter color, a thinner peel and contains a very juicy and acid pulp.

The lemon.

The *lime* is still smaller than the lemon; with the rind still smoother and thinner. It is rounded

at the extremities, of a pale or greenish yellow color, and abounds in juice. These are all used for similar purposes; mostly for the pleasant acid of their juice. The trees which bear them resemble the orange, in size and appearance. The fruit is gathered while yet somewhat green, and ripens after packing and exportation. The lemon is much used in flavoring, cooking, and drinks; and is far the most agreeable and useful of the three.

The lime.

PINE-APPLES.

The *pine-apple* is a native of tropical America, but has been diffused into other warm countries. It grows without much cultivation in Mexico, South America, Africa and the East and West Indies; and is often ripened in hot-houses in colder latitudes.

Pine-apple.

The stout stem of the fruit rises from a cluster of tough green leaves upon the ground, and bears on the summit a single fruit named from its resemblance in shape to a pine-cone. It is of a brownish yellow color when ripe, sweet, juicy, and of a delicious flavor. On the top is a tuft of green leaves which, if placed in the earth, will grow and produce a new plant. The pine-apples are picked before they are fully ripe, like most tropical fruits; and packed in boxes, are sent to all countries where they do not grow.

POMEGRANATES.

The *pomegranate* is the fruit of a tree belonging to a warm climate, though much cultivated as an

ornamental shrub where it does not produce fruit. Its native place is doubtful, but it grows wild on both shores of the Mediterranean, in Arabia, Persia, China and Japan, and has been introduced into most other countries where the climate is favorable. It often reaches a hight of twenty feet, with many branches, bright green leaves, and sometimes thorns. The flowers are large and of a rich scarlet. The fruit is about the size of an orange, covered with a thick rind and divided into numerous cells about the size and shape of a kernel of corn. These are filled with a pleasant acid juice, in which lies an oblong angular seed. The rind of the fruit, the bark of the root, and the flowers, are used in medicine, and are all very astringent. It thrives well in our Southern States.

The pomegranate tree and fruit.

TAMARINDS.

Tamarinds are the fruit of a tree growing both in the East and West Indies, and in other warm countries. It is cultivated for its shade as well as its fruit. The tamarind tree somewhat resembles the ash, in appearance, having a large lofty trunk and wide-spreading branches. The flowers are in clusters, and are of a yellowish color, beautifully variegated with red veins. The fruit consists of reddish or ash-colored pods, very much curved, from two to six inches long, and containing from four to eight or ten brown, flat, four-sided seeds, in cells, covered with a tough membrane. Outside of this mem-

Tamarind tree and fruit.

brane is a light-colored acid pulp, which gives the peculiar flavor to the fruit. The external covering of the pod is very brittle and easily separated from it.

Preparation for commerce.

Tamarinds are prepared for commerce by taking off the outer coating of the pods, placing them in a cask in layers, and pouring over them boiling syrup. Sometimes they are put in stone jars between layers of powdered sugar. As we obtain them, they form a dark-colored adhesive mass, of a slightly acid and very agreeable taste. They are much used for the sick, and are brought to us chiefly from the West Indies.

BANANAS.

The *banana* and *plantain* are also natives of the West Indies but are now cultivated in many other tropical countries, where they are used as an article of subsistence.

Description of the banana.

The plant is herbaceous, juicy, and of very rapid growth. Suckers are planted, and in about eight months they flower and begin to develop the cluster of fruit which is ripe enough to gather in the tenth month. The leaves are often ten feet long and two broad; the flowers grow in bunches between them. Sprouts come up from the parent plant and produce fruit soon after; so that a plantation of bananas perpetuates itself with little care or labor.

No plant produces so great an amount of nutritious food on a given space. Humboldt estimated

that a tract of ground planted with the banana, would yield one hundred and thirty-three times as much food as a similar extent sown with wheat. In Mexico it furnishes a large part of the food of the people. Value as a food plant.

The cluster is cut off before it is ripe, and brought to our northern ports, where it is esteemed a great luxury.

BREAD FRUIT.

Bread fruit is the production of a tree that grows wild in many of the Pacific Islands. It is about forty feet in hight with large spreading branches and beautiful green leaves, sometimes a foot and a half long and deeply lobed like those of the fig-tree, which they resemble, not only in color and appearance, but also in exuding a milky juice when broken.

The fruit is as large or larger than a cocoanut containing a core and a somewhat fibrous pulp around it, which, when ripe, becomes juicy and yellow. The eatable part lies between the skin and the core. It is snow white and has somewhat the consistence of new wheaten bread. It furnishes the islanders with a plentiful supply of nutritious food for many months in the year. Bread fruit.

The tree also supplies other needs of the natives. The inner bark, which is a network of fibres, is made into a kind of cloth; the wood is employed in constructing boats and habitations; the milky juice which flows out when an incision is made, furnishes a cement; the Other uses of the tree.

dried flowers are used as tinder, the large leaves for wrapping up food, etc.

The bread fruit tree has been introduced into the West India and other tropical islands, where it is used both as an article of food and luxury. It is not yet a commercial fruit to any great extent, but perhaps may become so, as well as many other productions of those tropical islands and regions which have been until recently almost unknown.

The explorations of late travelers have added vastly to our knowledge of the peculiar fruits and vegetables of those distant and rarely visited places; some of which will in time no doubt be more widely diffused in their cultivation, and become valuable articles of commerce. A few of them, described by Wallace and others may be mentioned here.

TROPICAL FRUITS LITTLE KNOWN.

THE CHIRIMOYA.

Where man has yet done little or nothing to improve the gifts of nature by cultivation, the fruits, even of the torrid zone, lack, as a general thing, the delicious flavor which long years of careful husbandry have imparted to those of a colder climate, such as our own. Yet there are rare exceptions and the *Peruvian chirimoya* is one. Travelers agree in applying to it such terms of admiration that we may reasonably conclude it is equal, if not superior,

Peruvian chirimoya.

to the most exquisite fruits of European growth. It abounds, and attains perfection in many parts of Peru, and the neighboring countries. The fruit is produced by a tree about twenty feet high, with a broad, dull-green crown of leaves. It is heart-shaped, with the broad base attached to the branch. The rind is green, covered with small tubercles and scales, and encloses a white juicy pulp with many black kernels embedded in it. Both fruit and blossoms exhale a delightful odor.

The fruit weighs fourteen or sixteen pounds, and the flavor is described as exquisitely delicious, though comparable to no other known.

THE LITCHI.

This is a small insignificant tree growing originally in China and Cochin-China; but its cultivation has now spread over most of the East and West Indies. It has lance-shaped leaves, small greenish-white flowers, and produces a plum-like scarlet fruit greatly relished by the Chinese, and commonly eaten with their tea. It is also dried in ovens and exported.

The litchi.

It is said that, in order to obtain the fruit in its perfection for the use of the Imperial court at Pekin, (which is in too high a latitude to produce it) the trees, as soon as they blossom, are conveyed from Canton to Pekin on rafts, at enormous trouble and expense, so that this luxury may be freshly ripe on its arrival at the northern capital.

How obtained in Pekin.

THE MANGOSTEEN.

The Molucca Islands are the home of this beautiful fruit, though it has been introduced into Java, Siam, the Philippines, and Ceylon. The tree which bears it resembles the citron and lemon. Its flowers are as large as roses and very handsome. The fruit is about the size of a small apple, and tastes, according to travelers, like a mixture of strawberries, raspberries, grapes and oranges. It is also said that the sick person who has lost an appetite for everything else, still relishes the mangosteen; and that the case is considered perfectly hopeless when he refuses it.

Flavor of the mangosteen.

THE DURION.

In various islands of the Malayan Archipelago is found the *durion*, a fruit utterly unknown in Europe and America even by description, until very lately. It stands apart from all other vegetable productions by possessing the opposite qualities of extreme offensiveness to the smell, while it is most delicious to the taste. The *odor* is like that of *decaying onions;* while the *flavor* is such that those who have once partaken of it prefer it to all other fruit.

The durion and its opposite qualities.

Wallace, in his "Malayan Archipelago" gives the following account of it:

"The durion grows on a large and lofty forest tree, somewhat resembling an elm in its general character, but with a more smooth and scaly bark.

The fruit is round or slightly oval, about the size of a large cocoa-nut, of a green color, and covered all over with short, stout spines, the bases of which touch each other, the points being very strong and sharp. It is so completely armed, that if the stem is broken off, it is a very difficult matter to lift one from the ground. The outer rind is so thick and tough, that from whatever hight it may fall, it is never broken. From the base to the point there are five faint lines to be seen, which show where the fruit may be divided with a heavy knife and a strong hand. The five cells are white within, and filled with an oval mass of cream-colored pulp, in which two or three seeds, about the size of chestnuts, lie embedded. The pulp is the eatable part, and its consistence and flavor are indescribable. A rich butter-like custard, spiced with almonds, gives the best general idea of it. There is a glutinous smoothness in the pulp which nothing else possesses, but which adds to it delicacy. It is neither acid, nor sweet, nor juicy; yet one feels the want of none of these qualities, for it is perfect in itself. It produces no bad effect, and the more one eats the more he is inclined to. When the durion is ripe it falls from the tree daily and almost hourly, and accidents frequently happen to those who are walking or working under the trees. When it strikes a man with its strong spines it produces a dreadful wound, tearing open the flesh, besides severely bruising it. In a good fruit season, large quantities are preserved by the natives in salt,

Wallace's account of the durion.

Ripening and preservation of the fruit.

thus keeping it the year round. It acquires by this mode of preservation a smell intolerably disgusting to Europeans, though the natives find that no objection. They eat it as a relish with their rice." Wallace calls the orange and durion the "king and queen of fruits."

THE CASHEW FRUIT.

This singular production of the West Indies and tropical South America is a kind of compound fruit borne by a small tree belonging to the Sumac family. It is about the size of an orange, and contains an acrid juice, from which a pleasant wine is made. At the base of this fruit or apple, grows a large, flattened, kidney-shaped nut, having a hard external shell, between which and the shell of the kernel, is a strong caustic oil. The kernel, when fresh, is used as an article of food, and is said to be of a delicious taste. The oil around the kernel, makes an enduring color on cloth, and for this reason the nut is sometimes called the *marking nut.*

Fruit and nut.

NUTS.

BRAZIL-NUTS.

These are the fruit of a splendid tree (the Juvia) growing sometimes to the hight of more than a hundred feet on the banks of the Orinoco, and in the northern parts of Brazil, whence they derive

the name. The nuts are triangular in shape, the shell rough and hard, of a brownish color, and contain a great deal of oil which may be extracted by pressing. These nuts do not grow singly, but in a large outer shell which contains from fifteen to twenty packed closely inside. This shell is so hard as to be broken open with difficulty. The natives are extremely fond of this nut and celebrate the harvest of the Zuvia with rejoicings. It is also much esteemed elsewhere, and large quantities are annually exported to foreign countries, chiefly from the port of Para, near the Amazon.

Brazil-nuts.

COCOA-NUTS.

The *cocoa-nut* is the fruit of a species of palm which grows in the West Indies, and the tropical islands of the Indian and Pacific oceans. It rises without branches to the hight of sixty or seventy feet, having the leaves in a tuft at the top. These leaves are of great size, being fifteen or twenty feet in length, and among them the flowers appear, and the fruit hangs in a cluster of a dozen or more.

Cocoa-nut palm.

The nut is of an oval shape, with a woody shell, surrounded by a fibrous coating, and contains a firm fleshy kernel, white, and of a rich oily taste. When unripe this substance is of a milky consistence. The nut is used in many kinds of cookery and confectionery. Oil is pressed from it which is employed in making toilet soaps and in other cosmetic prepara-

The nut and its uses.

tions. Large quantities reach us from the West Indies.

The cocoa-palm is a very useful tree to the natives of the islands where it grows. The trunk furnishes wood, the fruit food, the shell is used for household purposes, cloth is made from the fibres, and houses are thatched with the leaves.

OTHER NUTS.

There are many other species of nut which serve for food to some extent, in both warm and cold countries; but though a few of them are articles of commerce we can not afford space to give each a separate description; which is the less necessary, as most of them are well and widely known. The walnut, chestnut, hazel-nut, pecan-nut, butternut, and many others might be mentioned. They are all oily, and some yield large quantities to heavy pressure; especially the cocoa and other nuts of palm-trees. Many thousand tons of oil are annually employed in making candles and soaps.

Other nuts.

CHAPTER II.

COMMERCIAL ARTICLES OF ANIMAL FOOD.

SECTION I.—MEATS, BUTTER, CHEESE, Etc.

THE articles of animal food known to commerce are few compared with those of vegetable origin.

Beef and pork, salted and packed in barrels, furnish a very considerable article of home consumption as well as of ship stores and export from the Northern, Middle and Western States to Southern ports and the West Indies. *Jerked beef* is prepared by cutting the flesh into strips and drying in the sun. It is a method of preserving meat much practiced in South America and furnishes a valuable food from the slaughter of wild cattle. Beef is also cured and dried after a pickling process, in masses, from which thin bits are sliced as a relish for the table.

Beef and pork salted.

Jerked and dried beef.

Hams, salted and smoked, and lard, are also important commercial articles, of universal use in this country, and mostly furnished by the Middle and Western States.

Hams and lard.

Venison is the flesh of the deer and is often sent in winter in a frozen state from the North and West

to the Eastern market. By many it is esteemed a great luxury.

The process of *canning* has also been applied successfully to meats in a fresh state; so that they may now be cooked in one country and eaten in another.

Pemmican is meat cut in slices, dried in the sun, and then pounded up and mixed with fat. Sometimes dried fruit is put in to improve the taste. It is packed firmly into bags, and as it contains a great amount of nutriment in very small compass, it is an invaluable article of food for exploring parties or those who are obliged to transport food a considerable distance. This mode of preparing meat was derived from the American Indians.

Pemmican.

Another form in which the nutritious principles of meat may be greatly concentrated and long preserved, is in *meat biscuit*. This is an article of recent date, but it has taken the place its importance deserves, especially among ship stores. The American meat biscuit is largely manufactured in Galveston, Texas, from the meat of cattle in that region. This is boiled till all the nutritive qualities are extracted. The liquor is then strained and evaporated by heat till quite thick. While it is hot, flour is added, and it is kneaded into a stiff dough, which is rolled, pressed, made into biscuits, and baked. These are kept whole or are ground to powder and preserved in air-tight cans ready for export or use.

American meat biscuit.

The employment of this article on shipboard,

especially on vessels destined to long voyages, promises a remedy for scurvy, that disease which is peculiarly the scourge of seamen, and is the result of long confinement to a salt diet.

BUTTER AND CHEESE.

Among manufactured articles of animal food, *butter* and *cheese* hold the first rank. The well-known process of making them from the milk of the cow need not be described. To a great extent this is done in the dairy of the farmer, whence it passes into the market; but in some places the milk of an entire farming district is manufactured into cheese in extensive establishments erected for the purpose.

Butter and cheese.

Milk is also *condensed* and *canned* for export in these establishments; and thus another valuable article is added to the commercial list.

Condensed milk.

Butter is packed in tubs and firkins for exportation. Great quantities are sent from the northern to the southern market.

GELATINE, ISINGLASS, ETC.

These are prepared from various animal substances by the action of boiling water upon them. Common glue is dried gelatine, made from the skin, hoofs, etc., of cattle, by dissolving these and then evaporating the water. It forms a tough jelly which is cut by wires into thin layers

Common glue.

and dried by exposure to the air. This is much used in various ways in the arts and manufactures.

The nicer preparations of gelatine are employed as food in soups, jellies, etc., as also as a diet for the sick. When pure it is colorless and transparent.

Isinglass. *Isinglass*, which is the purest and best form of the article, is obtained from the air-bladders of certain fish, especially the sturgeon. The nicest comes from Russia, though it is manufactured in many places. Refined isinglass is made by dissolving the common quality in hot water and drying again on oiled muslins.

SECTION II.—FISH.

Importance of fish in commerce. FISH is one of the most valuable articles of animal food; and the business of catching, curing, or otherwise preparing it for market, gives life to one of the main departments of commerce. It employs innumerable vessels, and vast numbers of men every year in all parts of the globe.

COD.

Cod-fishing. The *Cod-fish* is the most important of all, and its fisheries the most extensive. The principal resorts of this fish are the Grand Bank of Newfoundland and others in that region, lying off the coasts of Great Britain, Nova Scotia

and New England; and hither thousands of vessels annually repair. From February to April their crews are employed from morning till night in boats containing from two to four men each. Sometimes a good fisherman will catch several hundred in a day; but it is hard work, as they are caught with a hook and line, and some of them are very heavy. They often bite with such rapidity that a boat is loaded in two or three hours.

On the shore stages or platforms are erected, where the fish are cleaned, salted and dried. Great labor is required to do this in a proper manner; but after they are sufficiently cured they are piled in warehouses for shipment, and eventually carried to all parts of the civilized world.

Process of curing.

This fish is also used fresh, being transported on ice by railroad, to places at a considerable distance from the waters where they are taken.

Cod are caught likewise from the decks of the fishing vessels, with lines from thirty to forty fathoms in length. They average about fourteen pounds in weight, though some are taken of forty or fifty. When a fish proves too heavy for the line, the fisherman calls on his neighbor, who strikes a hook attached to a long pole into the fish, and then safely hauls it on deck. After fishing for hours a large quantity are accumulated upon deck, where they are thrown from the lines. To make room it is necessary to "dress them down" as it is called. This is done on long planks resting upon barrels and forming

Fishing for cod on the Grand Bank.

a narrow table. The whole crew divide themselves into *throaters*, *headers*, *splitters*, *salters*, and *packers*. The *throater* commences the operation of "dressing" by drawing his knife across the throat of the fish and ripping open its body. He then passes it to the *header* who wrenches off the head and tears out the entrails which he casts overboard, passing the fish at the same time to the *splitter*, who with one cut lays it open from head to tail and then in an instant removes the back-bone. The *tongues* and *sounds* are taken out and packed in barrels by themselves as a luxury. The fish next goes to the *salter* and then are packed ready to be brought into port and there dried.

Dressing cod.

In some places where the water is sufficiently shallow these fish are now caught in sieves or nets.

MACKEREL.

The *mackerel* is found in greater abundance near the shore than far out at sea. Immense numbers are annually caught with hook and line along the coast of New England. They are salted and packed in barrels on shipboard, and sent to different parts of the United States and the West Indies. The trade in this fish is considerable both in its bulk and salted state.

Mackerel.

SALMON.

The *salmon* is a salt water fish but comes annually into our rivers to deposit its spawn. Those

of Maine furnish immense supplies of this most delicious fish, which are taken in nets on their return to the sea. It is cured by drying, or preserved by pickling and canning. It has a yellowish red color, and is very highly esteemed for the table.

Salmon.

HALIBUT.

The *halibut* is a large sea-fish weighing from fifty to two hundred pounds. It is found in northern waters, and caught with difficulty and exposure amid the rigors of winter, principally on George's Bank. This is a branch of fishery of recent establishment. At Boston and a few other places, the fish are received, packed in boxes with ice, and sent by rail or steamboat to distant sections of the country.

The halibut.

SHAD.

The *shad* is a very fine fish, which, like the salmon, visits the northern rivers for the purpose of depositing its eggs. Large numbers are taken in seines in the spring. The shad is considered a great luxury for the table.

Shad.

HERRINGS.

The *herring* is a very important article of commerce, on account of the vast numbers to whom it furnishes an employment as well as a cheap and

wholesome food. It is common to the seas of Europe as well as this country. From April to September they are taken in enormous quantities, and after being pickled in barrels, or dried and smoked, are ready for exportation and use.

Herring.

SARDINES.

The *sardine* is a fish of the herring tribe, but smaller. To some extent it is taken in our own waters, but is exceedingly plentiful on the coasts of Portugal, Spain and Italy. A very small kind caught on the western shores of France is considered the best. The sardines are prepared for market, either in oil in small tin boxes, or put in brine in casks. They are thus exported in large quantities. While fresh they are used for food by the poorer classes.

Sardines.

TURBOT.

The *turbot* is a nice fish which is caught both on the coasts of Holland and England, in the North Sea. It is a flat fish and haunts the bottom of the sea near some sand-bank which is always covered with water. The mode of taking the turbot is peculiar. Many baited hooks are attached by horse-hair to one line, which is anchored at both ends to keep it steady, with a buoy attached to show where it may be found. The lines are laid across the current of the tide, and allowed to remain six hours till the tide turns.

Turbot.

When the lines are taken up fish are found upon most of the hooks.

SHRIMPS AND ANCHOVIES.

Shrimps and *anchovies* are small fish much used for sauces. Shrimps somewhat resemble the lobster and are caught with nets in the spring of the year. They are found in abundance at the mouth of the Thames. The anchovy is taken in the Mediterranean on the shores of Spain, France and Italy. The fishermen catch them at night by carrying a light at the hinder part of their boat, around which the fish are sure to crowd. They are then easily taken in a net. When sound and good, the anchovy will wholly melt in the sauce. It is kept prepared for this use, and also by pickling, for exportation.

Shrimps and anchovies.

OYSTERS.

The *oyster* is found in almost all parts of the world. It inhabits shallow places by the shore, and attaches itself by its shell to rocks or other fixed substances. Oysters are artificially reared and fattened in beds of mud and sand on the edge of shores where they are visited by the tide water. These are often very large, nice, and in great demand. Oysters are transmitted to market in the shell, or are removed from it and pickled in small kegs.

Oysters.

There is a very extensive trade in oysters as they are used everywhere for the table.

LOBSTERS.

The *lobster* is found along the coasts of this country and Europe, and furnishes a considerable article of traffic at certain seasons of the year.

Lobsters.

The European species is destitute of the large claws which distinguish those most used in this country. The lobster is boiled before being offered for sale, and its color is thus changed from a dark green to a bright scarlet.

TURTLE.

The *turtle* is the sea-tortoise. There are several species, some of which are not fit for food. The sort most esteemed for the table is the green turtle, so named from the color of its fat. This color is supposed to be imparted by its food, called turtle-grass, which grows at the bottom of the seas of the torrid zone which it inhabits. Great numbers of turtles are brought to us from the Bahama Islands, being kept in large tubs or tanks. Some are of immense size, often measuring five feet in length and weighing five or six hundred pounds. Soups made from the green turtle are considered a great luxury.

The green turtle.

In the month of April they go on shore during the night to lay their eggs. The men who are on the watch for them need only turn them on their backs to secure them, as they are unable to regain a natural position. The hawk's-bill turtle is not valued for food,

Mode of capture.

but for the shell which furnishes the beautiful tortoise shell of commerce. "It is caught all over the tropical seas, but principally near the Moluccas, the West Indies, and the Fiji Islands. In the latter the chiefs preserve it in pens, to obtain supplies of the shell. They have a barbarous way of removing the valuable part from the living animal. A burning brand is held close to the outer shell until it curls up and separates a little from that beneath. Into the gap thus formed, a small wooden wedge is inserted, by which the whole is easily peeled from the back. When thus stripped, the turtle is again put into the pen, and time allowed for the growth of a new shell. This cruel process appears to give the poor animal great pain, though it is not fatal."* Tortoise shell.

Other kinds of shell-fish are used for food, but those already mentioned are the most important.

*Hartwig.

CHAPTER III.

SAVORS, SPICES, CONDIMENTS, ETC., USED WITH FOOD OR IN ITS PREPARATION.

SALT.

THIS substance, so necessary to man, and for which many animals have an instinctive relish, is widely and plentifully diffused over the globe. It exists naturally both in a solid state and in solution. In its solid form it is called *rock* or *fossil* salt, and is often found in extensive beds, and even entire mountains, from which it is extracted by mining operations. In solution it exists in certain springs and lakes, and in the water of the ocean, from which it is obtained by various processes of evaporation.

Salt.

Salt mines are found in almost every country of Europe, in various parts of Asia, Africa and America. The most noted are those of Russia. That of Cracow, in Poland, is located in an enormous mass of rock salt estimated to be five hundred miles in length, twenty broad, and not less than twelve hundred feet thick.

Salt mines.

In the United States salt is mostly obtained by evaporating the water of saline springs and that

of the sea. The most productive springs are those of Onondaga county in the State of New York. Those in Virginia are next in importance.

Bay salt is that which is evaporated from sea water by the heat of the sun. It is called by this name from having been manufactured first in the Bay of St. Ubes, in Portugal. Bay salt.

Large quantities of salt come from Turk's Island in the West Indies, and it is an important article of commerce in many countries. The impurities are generally removed by re-dissolving, and clarifying the brine. It is of various degrees of fineness, according to the purpose for which it is to be used.

Salt is an indispensable aid in preserving meats, fish, and other articles of food; and is also of great importance in chemistry and medicine.

SUGAR.

Sugar has been known from very ancient times. The sugar-cane from which most of the sugar of commerce is extracted is thought to have originated in Asia, though it was very early introduced into other countries, and is now common to all tropical regions of the globe. At first sugar was used as a medicine; for a long period it was an expensive luxury, but now it has become a necessary article of table use the world over, and as a consequence, its manufacture is very extensive in both continents. Sugar.

The *cane* is an herbaceous plant, with a jointed

stem which rises to the hight of three, six, and sometimes twelve feet, according to the richness of the soil, and is from one to two inches in diameter. It is made up of a luscious juice and a fibrous portion. The joints are from forty to sixty in number, and each is or has been embraced by a leaf in the same manner as that of the Indian corn, to which the sugar-cane has a general resemblance in its mode of growth. It is cultivated by cuttings, planted in rows. The top joints of the stems which are less rich in juice but equally strong to grow, are laid in the ground and sprout from every joint, thus affording plenty of plants for a new crop. The flowers rise in a tuft or plume, like that of the maize, and are of a pink or lilac color. In five or six months after the blossoming, the canes are ripe, and become of a golden yellow, sometimes streaked with red. They are then cut down close to the earth, topped, stripped of their leaves, and crushed in a mill between iron rollers. The juice, which flows very freely, is collected in a cistern and heated gently with a little lime to correct the acid which abounds in it. After many processes of boiling, skimming, straining, etc., it is allowed to run into broad shallow vessels called *coolers*, where it begins to granulate. It is then removed into other vessels perforated at the bottom to allow the fluid portion which will not crystallize to drain off. In this state it is called *raw* or *brown sugar*, and the liquor thus drained from it is the common *molasses* of commerce.

The cane.

Mode of cultivating the cane.

Sugar making.

The refining process by which raw sugar is rendered pure and white is a distinct branch of the business, and is not usually carried on where the sugar is made. It consists mainly in remelting and mingling with it certain substances which cause the scum and all impurities to rise to the surface where they are removed. After several repetitions of this cleansing process the syrup is allowed to cool and harden. When poured into moulds it is called *loaf sugar;* broken up into small pieces it is *lump sugar;* ground to various degrees of fineness, it goes by the names of *granulated*, *pulverized* or *powdered* sugar. The drainings from refined sugar go by the name of *syrups*.

Refining sugar.

The manufacture of sugar has been greatly improved by the introduction of steam power, by which the juice is much more rapidly and thoroughly pressed out between the iron rollers which are set in motion by it. Other improvements consist in methods for separating the granulated or crystallized particles of sugar from the molasses without the long and imperfect process of draining formerly used.

Improvements in the sugar manufacture.

The raw sugar is placed in a large, square iron case, air-tight, divided into two compartments by a sieve-like bottom of wire with fine meshes. The sugar is placed in the upper compartment while the lower one communicates with two air pumps that are set in motion by the engine which crushes the canes. When the air is exhausted in this lower compartment, the liquid molasses comes pouring in

to fill the void, while the crystallized mass remains almost thoroughly purified at the top. The old method of draining in casks, pierced with holes at the bottom, required at least eight days, and then retained a quantity of molasses; while by the new mode, the cleansing is effectually accomplished in a few hours, and at the same time the sugar has a much nicer appearance, and moreover can immediately be packed in hogsheads and casks for shipment.

Sugar is also made from many other plants. The maple-tree, date-palm, and beet-root, are the most important for the amount of it they produce. The sap of the *maple* is boiled down till crystallization takes place. It is obtained in the early spring by boring through the bark into the wood of the tree. A spout being introduced the sap flows out into any vessel placed to receive it. The flavor of maple sugar is very agreeable. *Beets* are crushed and the liquid part pressed out. It is then boiled down and crystallized. Large quantities are made in France. In India and the South Pacific islands sugar is made from the date-palm. It is estimated, however, that about eleven-twelfths of all the sugar extracted for use is obtained from the sugar-cane, and that the annual production from this source over the whole globe amounts to 4,500,000,000 pounds. Immense quantities are produced in the West Indies, where the plant reaches its highest perfection. In Louisiana and other regions of the Gulf coast, there are many large and productive plantations.

Other sugars.

Annual amount.

Although highly nutritious, sugar is not usually eaten by itself, but enters into the preparation of food. An enormous amount is annually consumed in candies and confections of every kind.

MOLASSES.

Molasses, as has been before mentioned, is the liquid which is drained from raw or brown sugar, through perforations in the casks containing it, or by improved methods already described. The quantity produced, depends greatly upon the degree of heat employed in boiling the cane juice. The greater amount of heat, the greater the proportion of molasses. In improved processes for the manufacture of raw sugar, and for refining it, the syrup is heated in what are called "vacuum pans," which are large metallic boilers so constructed that they can be exhausted of air. The boiling point of the syrup is consequently so much reduced that very little molasses is formed.

Production of molasses.

This well-known liquid is of a darker or lighter color according to its purity. It is used in innumerable ways in cooking, etc. A great amount is annually distilled into rum, both in this country and the West Indies.

HONEY.

Before the manufacture of sugar was well understood honey was extensively used as a sweetener of wines, food, etc., but now principally as a

table luxury. It is a deliciously sweet substance collected by bees from flowers. The finest honey is that which is allowed to drain from the comb. If obtained from hives that have never swarmed, it is called "*virgin honey.*" An inferior quality is procured by exposing the comb to pressure; and if heat be employed, the product is still more impure. Much honey is collected in different parts of the United States. It is imported in barrels from Cuba and other parts of the West Indies.

Honey and its uses.

The drink known by the name of *mead* or *metheglin*, is partially composed of honey. It enters also into some medicinal preparations.

VINEGAR.

This well-known acid is obtained in various ways, but chiefly by exposing wines, cider, or malt liquors to the air and a slow fermentation. In this country cider is most used, and by allowing the casks to stand with the bung-holes open, exposed to the heat of the summer sun, the cider is gradually changed into vinegar.

Cider or wine vinegar.

A method, however, borrowed from the Germans, of producing vinegar by a much quicker process has lately come into use. By mixing certain proportions of alcohol and water, (with a little yeast added,) and allowing it to trickle several times slowly through a quantity of beech shavings previously steeped in vinegar,

Quick method.

the process is greatly hastened, and good vinegar is thus made in from twenty-four to thirty-six hours.

Vinegar is often adulterated, and injurious mixtures under the name offered in market. The various culinary uses of vinegar are well known. It is also used extensively in some manufactures and dyes.

OLIVE OIL.

The *olive tree* is a native of the south of Europe and is extensively cultivated in France, Italy, Spain, and other countries bordering upon the Mediterranean. Its trunk reaches the hight of twenty or thirty feet, and makes valuable timber. The fruit is the most useful part of the tree. The olive. This is a smooth oval plum, about three-fourths of a inch in length and one-half in diameter. It is of a deep violet color when ripe, whitish and fleshy within, of a bitter and nauseous taste, but filled with oil, which is pressed from it and used for many culinary and medicinal purposes. Olives are also used for pickling; and such are gathered before they are ripe. Those designed to produce the oil are bruised, and then subjected to heavy pressure. The first oil that flows is the best. Olive oil. Olive oil is imported in glass bottles, or in flasks surrounded by a peculiar kind of network made of grass and called *Florence flasks*. The best oil comes from the south of France. It is much used in preparing and preserving certain kinds of food (like sardines

and some other sorts of fish,) and also as a dressing for salads.

PEPPER.

The principal varieties of this spice are *cayenne* and *black pepper.*

The first is now cultivated almost everywhere though it is thought to be a native of the warm regions of both Asia and America. Large quantities have long been produced in Guiana, South America, and exported from the port of Cayenne, whence its name of cayenne pepper. While green this fruit is much used for pickling, and is familiar to every one. When ripe it becomes of a bright handsome red, and after drying, it is powdered and brought into market. Besides what is produced in this country, it is imported from the West Indies.

Cayenne pepper.

Black pepper is the fruit of a climbing shrub which grows wild in some parts of China and India. It is cultivated in most of the East India islands; the best is said to be produced on the Malabar coast, in Sumatra, Borneo, Java, and Singapore. The plant is propagated by cuttings and is supported by poles and props, or by trees of various kinds planted for the purpose, upon which it is trained. It grows ten or twelve feet and sometimes more. In three or four years from the time of planting it begins to bear fruit. The leaf resembles the ivy. The flowers are in clusters, small and whitish, the berries globular, and when fully ripe of a red color. The fruit is gathered twice a

Black pepper.

year, before ripening, and upon being dried becomes black and wrinkled. The taste is fiery and pungent. Pepper is much used as a table condiment and in medicine. The black and white sorts of pepper are both the products of the same plant.

The peppers brought *white* from the plantations, are supposed to be the finest berries which have dropped from the vines, and become somewhat bleached by exposure to the sun and weather. But the greater part of the white pepper used as a condiment is the black pepper from which the dark coating has been removed. In this state it presents a handsomer appearance, and brings a higher price; but the pungency of the spice is diminished as well as its real value.

White pepper.

MUSTARD.

There are two species of *mustard*, both very common, and easily cultivated; the black and white. The seeds of both are used, and are sold whole or in powder ready for the table. The plant is too familiar to every one to need description. Mustard seed is also a valuable medicine, mostly used externally to excite redness in the skin and relieve pain.

Mustard.

GINGER.

The *ginger plant* is a native of Hindoostan and is cultivated in all parts of India and also in the West Indies, where it has been introduced from the East. The plant is somewhat rush-like, with a

creeping root a little beneath the surface of the earth. The stem, which is annual, grows from two to three feet high. The flower stalk rises by the side of the stem, from six to twelve inches in hight and bears a scaly spike of white and blue flowers. The root is fit for use after it is a year old. In the West Indies the ginger crop is gathered in January and February, after the stems have withered. The root is scalded after having been well washed, and then dried as quickly as possible. The dark colored ginger is imported from Calcutta. The Jamaica or white ginger comes from the West Indies. It is deprived of its outer coat and when pulverized makes the yellowish powder known to every one, so much used in culinary preparations and drinks.

Ginger plant.

Preparation of the root.

The fresh root is sometimes brought into market and preserved by confectioners by boiling in syrup. It is also brought in jars from the East, already preserved.

PIMENTO, ALLSPICE OR JAMAICA PEPPER.

These names are all given to the same article. In this country it is usually known by the second, or *allspice*, because it is thought to resemble in odor a mixture of cloves, nutmeg, and cinnamon. It is the unripe berry of a tree which grows in the West Indies, Mexico and some parts of South America. Being particularly abundant in the island of Jamaica, it has received the name of Jamaica pepper. The tree is about thirty feet high, with a straight

trunk, smooth gray bark, evergreen foliage, and small fragrant white flowers. The fruit is a round berry, smooth, shining, and of a dark purple or black color. It is gathered when it has attained its full size, though not yet ripe, and after being carefully dried in the sun is ready for market. Allspice is brought in bags and casks from the West Indies, and is often pulverized and put up in small boxes ready for family use.

Growth and preparation of allspice.

The pimento plant belongs to the myrtle family, and is in appearance a very beautiful tree. It grows spontaneously in many parts of Jamaica. Attempts to propagate it are, (Edwards informs us) very generally unsuccessful. He says that not one in fifty efforts to raise it from cuttings or the seed have resulted favorably. Its growth is therefore left principally to nature. "When a new plantation is to be formed, no regular planting or sowing takes place, but a piece of land is chosen either in the neighborhood of a plantation already formed, or in a part of the woodland where the trees are scattered in a native state. The land is then cleared of all wood except the pimento myrtles, and the felled timber left to decay where it lies. In a short time young pimento plants are found springing up on all parts of the land, produced, it is supposed, from the ripe berries scattered by the birds, while the prostrate trees protect and shade the tender seedlings. At the end of two years the tract is thoroughly cleared and none but the most vigorous

Plantations of pimento.

plants left standing. These come to maturity in about seven years.

"When the fruit is ripe one climbs the tree and gathers the small branches, while others, usually women and children, pick the berries from them. They need to lie in the sun for a week, or till they are fully dry, and are then fit for packing and exportation."

NUTMEG AND MACE.

The *nutmeg tree* is a native of the Molucca or Spice Islands, but is cultivated in many others both of the East and West Indies. The Banda Islands, however, produce it in the greatest abundance and perfection. The tree grows from thirty to fifty feet high with numerous branches, bright green glossy leaves, and small white bell-shaped flowers. It has considerable resemblance to the orange tree. The fruit, which appears mingled with the flowers, is about the size of a small peach; at first pale green, but yellow when ripe. The external covering, which is first thick and fleshy, then becomes dry and stiff and separates into halves, disclosing a scarlet network adhering to a shining black nut. This network is the *mace* of commerce, and is carefully separated, dried and packed closely, breaking it up as little as possible. The nuts are then dried till the husk is readily removed; afterwards they are steeped in sea water and lime to preserve the flavor, and then packed in casks or chests for exportation. Nutmegs may be gathered three times

Nutmeg tree and fruit.

Mace.

a year. Both nutmeg and mace are much used in cookery.

CINNAMON AND CASSIA.

The *cinnamon tree*, whose bark furnishes the spice so well known, is a species of laurel, which grows spontaneously in the forests of Ceylon. It is also largely cultivated there in gardens and plantations which furnish supplies for foreign trade. India and Java also produce it, as well as some of the West Indian Islands, where it has been introduced.

Native country of the cinnamon tree.

If left to its full growth, the cinnamon tree will attain a hight of thirty or forty feet, and a diameter of eighteen or twenty inches; but as the best spice is produced from young shoots, the main trunk is kept cut down and new growths from the root allowed to spring every season, and never grow more than ten feet. The shrubs are placed in regular rows, four or five feet apart. The shoots with their slender stems somewhat resemble the hazel, and are covered with leaves which at first appear partly of a bright red, and partly of a pale yellow color. When mature, however, the upper surface is of a dark olive tint, and the under one of a lighter green. The flowers grow on footstalks at the angles of the leaves and at the extremity of the branches, in clusters somewhat like the lilac in shape and size, but are white with a brownish tinge in the center. The odor is not particularly agreeable. One-seeded berries, shaped like an acorn and smaller

Mode of growth and cultivation.

than a common pea, constitute the fruit. The plants are propagated either by seeds or saplings. In two years the shoots are fit for cutting, being then about half an inch thick.

Gathering the bark.

The peeling of the rind takes place twice a year, from May to June, and in November, as the bark at those seasons can be easily detached from the wood. The outside having been scraped off, the bark is laid in the sun to dry, where it curls up and becomes of a darker color. The smaller pieces are then put inside the larger, and the whole closes up into a tube form such as we see it in shops.

Best cinnamon.

Cinnamon of the best quality is imported at the present day from Ceylon and the Malabar coast, obtained from the smaller twigs and shoots, which furnish the sweetest and strongest bark. It comes in bales and chests, the quills or tubes having been made up into bundles weighing about a pound each.

Oil of cinnamon.

An oil can be extracted from the bark by soaking and bruising up the pieces which have first been ground to a coarse powder. In this state it is allowed to stand in sea-water for two days and then distilled.

Cassia.

Cassia is another species of the cinnamon laurel, resembling it and producing bark in the same way. It is, however, inferior as to the delicacy of its flavor, and considered a coarser and cheaper spice, though not always readily distinguishable from it.

Cassia buds are the unopened flowers of the

cinnamon tree. They are of a dark brown color and aromatic taste like cinnamon.

CLOVES.

The *clove* of commerce is the unexpanded bud of a tree which grows spontaneously in the Spice Islands, but has been introduced into many other places where the climate is similar. The Dutch formerly endeavored to monopolize the cultivation of this spice, as well as the trade in it, but did not succeed. The name comes from the French *clou*, a nail, because the clove resembles a small nail. The tree which produces it is very handsome, with its glossy, evergreen foliage, and its constant succession of rosy, fragrant flowers. Its branches assume a pyramidal form, covered, like the trunk, with a smooth, grayish bark. When the buds have attained the proper size, they are picked by the hand or beaten from the tree, and quickly dried in the sun.

The clove tree.

The cultivation of the clove was formerly confined to the Molucca Islands, but it has been introduced into the West Indies and some of the tropical portions of South America, whence the United States derive their chief supply at present. The quality, however, is inferior to that which comes from the Moluccas, particularly from Amboyna.

VANILLA.

This flavor is prepared from the pod of a climbing plant growing in the West Indies, Mexico, and

the torrid portions of South America. The pods are gathered before they are quite mature, dried in the shade, covered with a coat of oil, and then tied in bundles and enveloped in sheet lead, or placed in small metallic boxes, ready for exportation.

Vanilla plant.

There are several varieties of the plant, of which the most valuable has pods six or eight inches long, and somewhat flattened. These contain within their tough shell a soft black pulp, in which numerous minute, black, glossy seeds are embedded. The entire pod has a peculiar, strong, agreeable odor and taste, but the pulpy portion is the most aromatic. Vanilla is used to flavor chocolate, ice cream, and various kinds of cookery and confections. It is sometimes used as a medicine, and as a perfume.

Varieties and uses.

In its wild state the vanilla vine, which is about as thick as a finger, will climb to the summit of the highest forest trees, but the fruit seldom ripens there, as the monkey commits constant depredations upon it.

It is a costly spice, and must remain so while among a *thousand* of its large and lovely blossoms, on an average but *one* pod is produced; which is the case under the present mode of cultivation.

YEAST.

Yeast is a frothy matter thrown off during the fermentation of malt liquors. It is used to excite a similar action in other substances, especially in mixtures of flour and meal, for the making of bread.

Yeast.

SODA.

Bread is also made by combining an alkali and an acid in the mixture; the effervescence taking place in it operates to make the bread, cake, etc., light and spongy when baked. Soda. The alkali now in general use is called soda. It is prepared from common salt by a chemical process.

CREAM OF TARTAR.

The acid commonly used with soda in cookery is called *cream of tartar*, (sometimes *Argol* or *Argals.*) It comes from the inside of wine casks, where it is deposited from the wine in a hard crust. Cream of tartar. It is red or white, according to the color of the wine. On being purified, it becomes a fine white substance, of a clear acid taste. It is used very extensively in cooking at the present day.

CHAPTER IV.

BEVERAGES.

THE drinks in most extensive use, not containing the alcoholic principle, are tea and coffee. Chocolate, with some of its preparations, such as broma, cocoa, shells, etc., are employed as table beverages to a considerable extent, but their use is not universal like that of tea and coffee. We commence therefore with some account of these.

SECTION I.—DRINKS NOT ALCOHOLIC.

TEA.

THE *tea plant* is a native of China and Japan, and is cultivated very extensively in both countries, particularly in the former. It is an evergreen shrub, usually from four to eight feet high; though in favorable situations it will grow much higher if permitted. It has numerous branches, and the leaves are smooth and shining. The flowers are of considerable size, snow-white, not unlike those of the myrtle in appearance, and are either solitary or stand two or three together at the angles of the leaves.

The tea plant.

Some writers are of opinion that there is but one species of the tea plant, and that the variety of the teas in appearance and flavor, depends on the age and manner of preparing the leaf. Others insist that there are two species; one producing the green and the other the black teas.

Two species of the plant.

In Japan the tea plant often forms hedge-rows around the rice and cornfields. In China, whence enormous quantities are exported, large fields are devoted to its culture. It is propagated from the seed, which is planted in holes, at certain distances apart, six or eight seeds being placed in one hole to ensure the growth of some of them. In three years the plant yields leaves for collection, and in as many more, attains its usual hight of five or six feet. After being cropped a few years, it is cut down in order that new shoots may spring from the stumps. These shoots afford a large product of leaves, and bear for several years.

Mode of cultivating tea.

The leaves are picked by hand, a crop being produced three times a year in the most favorable situations. The first is considered the best, as the leaves are then youngest. They are assorted according to age, and thus arise many varieties of strength and flavor. After having been gathered and assorted, the leaves are dried in shallow iron pans by artificial heat, and while still hot they are rolled by the fingers or in the palm of the hand into the form we see. They are then packed in chests, or boxes of various size

Preparation of the leaf for market.

for exportation or sale. These chests are lined with thin sheets of lead to exclude the air, which would soon diminish its fine flavor.

Commercial teas are of various names designating some quality or class. But they are all referable to the two great divisions of *green* and *black*, or else are mixed teas.

Extent of the use of tea.

So many ports are now open for trade between China and Japan and the rest of the globe, that this great staple is of world-wide consumption. Its gently stimulating qualities, united to its agreeable flavor, place it in the first rank as a table beverage; and the opinions of physicians and chemists are now almost unanimous that its use in moderation is not only harmless but absolutely beneficial.

Adulteration of tea.

Like almost all other commercial articles, tea is often adulterated. This is done in a great variety of ways. By coloring substances, by other leaves mingled with those of the tea plant, by drying and mixing the leaves already used with other fresh ones, etc., etc.

Some attempts have been made to introduce the tea plant into this country. In Greenville, South Carolina, the experiment of cultivating it has been tried within a few years, with such success as to induce the belief that the climate and soil of our Southern states would be highly favorable to the production of fair qualities of tea.

A colony of Chinese attempted its introduction into Brazil some years ago, but without success. The *maté or Paraguay tea*, is a substitute for it; and

this is a very abundant product in the interior and Western parts of South America. The leaves, the only part of the plant used, have a pleasant odor and bitterish taste, and are, at first, disagreeable to the palate. These leaves are said to contain principles identical with those of the Chinese tea.

Mate, or Paraguay tea.

COFFEE.

The mountainous regions of Abyssinia and Arabia are thought to be the original home of the *coffee-tree*, as it has here not only been cultivated from time immemorial, but is everywhere found growing wild in the forests. But the value of its produce has led to its introduction into various other parts of the globe where the climate is sufficiently warm. It is a small tree, fifteen or twenty, and sometimes thirty feet in hight. The lowest branches are longest, the higher diminishing towards the top so as to give a pyramidal form to the tree. The leaves are four or five inches long, dark green above and lighter beneath. The flowers are white, with a pleasant fragrance like jasmine. The fruit is a roundish berry, first green, then red, and ultimately of a dark purple color, about as large as a cherry. It contains two seeds, surrounded by a paper-like membrane, and enclosed in a pulpy substance. These seeds, divested of their coverings, constitute the *coffee* of commerce.

Coffee-tree.

The tree is raised from the seeds, which are first

sown in a soil properly prepared, and at the end of a year the seedlings are large enough to be transplanted into rows at suitable distances. These produce fruit in three or four years. The trees are topped to prevent their reaching an inconvenient hight, and to make them throw out a greater number of fruit-bearing branches. They continue to yield for thirty or forty years. There are two principal crops, although the trees are covered with flowers throughout the year. Various methods are employed to separate the seeds from their coverings; the best is by wooden rollers which remove the pulpy substance, leaving the paper-like membrane. They are afterwards divested of this by drying and winnowing.

Cultivation and crops.

Several varieties of coffee are known to commerce, principally named from the places where they are produced. The Mocha coffee is considered the best. South America and the West Indies contribute large quantities of coffee of very good quality. The East India and other tropical islands, also produce coffee. It is exported in sacks.

Varieties.

Coffee culture has undergone a great revolution within the last half century. Some of the countries formerly most noted for it, now occupy an inferior rank; while in others it has rapidly attained great importance. Brazil, which, at the beginning of the century was hardly known in the coffee trade, now furnishes nearly as much as all the rest of the

Changes in coffee culture.

world beside. It exported in 1855 more than *three hundred and fifty millions* of pounds, and has since added greatly to that amount; so that it has become the great coffee country of the world. Brazilian coffee.

Prof. Agassiz, in his late "Journey in Brazil," informs us that "more than half the coffee consumed on the globe is of Brazilian origin. And yet this coffee has, by itself, little reputation, and is even greatly underrated, because a great deal of the best produce of the Brazilian plantations is sold under the name of Java, Mocha, Bourbon," etc. The "so called Mocha," he says, "considered the finest of all coffees, is often nothing but the small round beans growing at the summit of the Brazilian plant very carefully selected and prepared."

The island of Java ranks next to Brazil in the production of coffee; and Ceylon stands third in the list. It is, however, cultivated largely in some of the West India and other islands besides in its native country of Arabia and Abyssinia. Other coffee growing countries.

It was here, of course, that the art of preparing a beverage from it was first discovered. Arabic writers relate that this took place about four hundred years ago. They say that a learned mufti (a Mohammedan priest or lawyer) of Aden, having tasted it while on a journey to the opposite shore of Africa, and discovered its virtures, recommended it to the dervishes (Mohammedan monks) of his convent, as a means of Properties of the beverage first discovered.

* Agassiz Journey in Brazil pp. 506, 507.

keeping them awake during their devotions. The example of these holy men was readily followed and it spread from tribe to tribe and from town to town, till at length its fame reached Constantinople, where the first coffee house was opened in 1554. Commerce with that city soon made it known in Europe and thence it has spread all over the world.

Coffee is prepared for use by roasting over a moderate fire till the bean is of a snuff-brown color and then grinding to a coarse powder.

CHOCOLATE.

Chocolate is a paste prepared from the seeds of the *cacao* or chocolate tree, a native production of Mexico; though in the West Indies, South America, and even in some parts of Africa, it is now largely cultivated. The tree is small but handsome, from twelve to twenty feet high, resembling a cherry tree. The fruit is an oblong cucumber-shaped berry, six or eight inches in length, with a thick rind enclosing a whitish pulp, in which are embedded numerous seeds, about as large as an almond. These seeds have a thin outer covering or shell, containing a brown, oily kernel. Separated from the substances which envelop them, these seeds or nuts constitute the *cacao* of commerce, from which chocolate is prepared.

Cacao or chocolate tree.

Linnæus gave to the chocolate tree the name of "*Theobroma*,"—food for gods—showing how highly he valued the flavor of its seeds; and there are many who consider the preparations from it the greatest of luxuries.

Theobroma.

The trees are purely tropical, and so tender that when young they require some screen from the scorching rays of the sun. Bananas, maize, manioc, and other broad leaved plants are therefore cultivated between the rows of cacao seedlings for shade and protection from wind. The flowers are of a pale red, springing from the large branches and even from the trunk and roots. The first fruits appear in the third year, but the tree does not come into full maturity till it is six or seven years old. It will then continue to bear abundant crops for twenty years.

Mode of growth.

When fully ripe the fruit is gathered, cut in slices, the nuts taken out, cleaned and dried in the sun. They are then put in bags and sent to other countries where they are manufactured. Before they are made into chocolate they are roasted and then reduced to a paste by grinding between hot stones; some spices are added, vanilla, cinnamon, etc., with a certain proportion of sugar, and then while hot, the paste is put in moulds to cool and harden. In this state it is the chocolate of the shops, and is prepared for table use by pulverizing and boiling in milk and water.

Preparation of chocolate.

Chocolate is extensively used by confectioners and made into a great many fanciful shapes.

The *cocoa* and *broma* which we obtain in small packages, are preparations of the nut in powder but not reduced to paste; often mingled with other ingredients. The *shells* of commerce, are the outer covering or shell

Cocoa, broma and shells.

of the nut, and impart to boiling water a taste similar to the chocolate but weaker. They are sometimes used as a substitute for tea or coffee.

SECTION II.—FERMENTED LIQUORS.

ALCOHOLIC liquids are divided into those *fermented* and *distilled*. The first class embraces all wines, cider, perry, arrack, etc., with those of every kind prepared from malt, such as ale, beer, porter, etc. The second contains those which have been separated from all such substances as have undergone vinous fermentation, by a process of distillation.

Division of alcoholic liquors.

Alcohol is the spirituous or intoxicating *principle* which is generated in vegetable juices by fermentation. In wines, beer, cider, etc., it exists, largely diluted with water. The object of distillation is to separate it from the water and other impurities, and collect it in a pure or concentrated form. This is done by placing the fermented liquor in an apparatus called a *still*, and subjecting it to a certain degree of heat. This raises the spirituous particles, which are very light and volatile, into the vapor. This passes off by a tube carried through a large quantity of cold water, to cool and condense it. At the extremity of the tube it flows out in a stream of alcoholic liquor. After several repetitions of this

Alcohol; how obtained.

process, it loses most of its watery particles and becomes pure *spirit of wine*, as it is called in commerce.

The word *alcohol* is from the Arabic language, and had originally no reference to liquors. *Alkohl*, the word from which it is derived, meant a fine pure powder, used for painting the eyebrows. The present application of the term is supposed to indicate fineness or purity of the spirit which goes under the name of alcohol. Derivation of the name.

WINE.

As fermentation must precede distillation, we will commence with fermented liquors used as beverages, naming *wine* first among them.

Many vegetable substances, especially fruits, may be made to afford wine, such as currants, cherries, and berries of various sorts; but that obtained from the grape is by far the most abundant and best known. Fruits affording wine.

Though the art of wine-making varies in different countries, yet there are some general rules everywhere observed. When the grapes are ripe they are gathered and crushed in wooden vessels with perforated bottoms, through which the juice, called the *must*, runs into a vat placed beneath. Here fermentation soon commences and the must is after a while covered with a mass of froth called the *bead*. The liquor becomes sharp and assumes a deep red color, if it be the product of purple or red grapes. After Wine-making.

the fermenting process has gone on long enough, the liquor having acquired a strong vinous taste and become perfectly clear, the wine is considered as formed, and is drawn off into casks.

Wines are made in many countries, and are known in commerce by various names, according to their source. Those most extensively imported to this country are Madeira wine, from the island of that name, north-west of the coast of Africa; port wine from Oporto, a city of Portugal; sherry wine from the vicinity of Xeres, in Spain (if genuine); champagne, burgundy, and claret wines, from several provinces in France, with other varieties from Germany.

Principal wines.

Wines are liable to adulteration, and sometimes contain very injurious substances. Mixtures, too, are sold under the name of wine, which contain little or none of the pure article.

According to their color, wines are divided into *red* and *white*. Red wines are derived from the must of black or purple grapes, fermented with their skins. White wines, from white grapes, or dark ones, fermented apart from their skins. Dealers also distinguish wines according to their taste, and other qualities, into two general descriptions; *sweet* or *luscious wines*, and *dry wines*, or such as are not sweet.

How wines are distinguished.

Wine is used as a common beverage by all classes of people in most countries where it is made in abundance, as in France, Spain and Italy. Where its importation renders it expensive it is not con-

sumed so freely as malt liquors, or even some inferior qualities of distilled spirits.

Much attention has been paid to the cultivation of the grape in this country within a few years, and considerable quantities of wine are produced annually in some of our Western and Southern States, where the climate seems well adapted to produce the choicest varieties of this delicious fruit. California stands foremost in the Union as a wine-producing State.

Native wines.

CIDER.

This well-known beverage is made from the juice of apples, which are ground in a mill, pressed, and the liquor placed in barrels to undergo fermentation. It was formerly considered a necessary part of the farmer's family stores, and as a common drink at his table. But at the present day orchards are much more devoted to the raising of valuable fruit, instead of an inferior quality, which is just as good for cider.

Cider.

It is a slightly intoxicating drink, and is often bottled for table use. Large quantities are annually converted into vinegar, and a brandy is produced from its distillation.

PERRY.

Perry is a liquor made from pears by a process similar to the manufacture of cider. It is a pleasant drink, and has sometimes been made of so excellent a flavor, and a quality

Perry.

so sparkling as almost to equal the genuine Champagne wine.

MALT LIQUORS.

BEER, ALE, PORTER, ETC.

Malt is the name given to grain which has been steeped in water till it is ready to germinate and then dried in a kiln, so as suddenly to check the process. It is ground up and used in brewing. Almost any grain can be used for this purpose, but barley is generally employed. Malt is the principal ingredient in all liquors of this class.

Malt.

BEER.

Beer is made by mixing malt with a quantity of warm water in what is called the *mash-tub*, which is a deep open vessel made for the purpose. After being well stirred and standing a few hours, it dissolves certain substances contained in the malt and becomes what is called *wort*. This is drawn off and more water added, and drawn off again till the strength of the malt is exhausted. The first solution is the sweetest and strongest.

Making beer.

The wort is next heated to boiling, and hops are added, which, besides imparting a peculiar bitterness and flavor to the liquid, helps to clarify it. It is then drawn into shallow vessels and cooled to a temperature of about 60° Farenheit. Yeast is then added and it is allowed to ferment. In a few hours

bubbles rise from all parts of the liquid, beginning at the edge of the vessel, and gradually increasing and spreading till the entire surface is covered with white creamy foam or froth. Yeast. After it has fermented sufficiently it is put into casks in which it is to remain till drawn off for use. Here a second and much slower fermentation takes place. This produces what is called the *ripening of the beer*, and is essential to its preservation. While it is going on, a brown froth is thrown off which is *yeast*, and is used largely in raising bread. The beer afterwards becomes clear and sparkling and is closely bunged or bottled, in order to exclude the air from it.

The varieties of beer depend upon some slight changes in the materials and their management in the process of brewing. The color of these liquors also depends in some degree upon the color imparted to the malt while drying in the kiln, and also upon certain substances used to give a deeper shade. Variety and colors.

Ale is the strongest of the malt liquors. It differs from the others by being made with a smaller quantity of hops, and is of a lighter color and sweeter taste. The first strength of the wort is used for it.

Porter and *brown stout* are of a darker color, being made of malt highly kiln-dried, or tinted with liquorice, burnt sugar, etc. Porter. It is said to derive its name from having been originally made great use of by the London porters. Brown stout is a superior quality of porter.

Lager-beer is so called from the long time it is laid aside or stored in vats or casks before it is fit for use. In making this beer the wort is fermented very slowly, in large open vessels, and the yeast, instead of rising to the top of the liquor, falls to the bottom and is separated so that it becomes as clear as champagne. It may be preserved for years without souring.

Lager or German beer.

In German the word *lager* means to lay, to place, or store away—as well as a *place* of *storage* or *deposit*—such as is required for the casks containing this favorite drink until it is ready for use. "*Lager bier*," therefore, in the simplest English means *laid away beer*.

Some changes and improvements are made, from time to time in the methods of brewing and preparing malt liquors; but the general principles and processes of the art are such as have been given above.

They are made and used very extensively in Germany, England, and this country.

SECTION III.—DISTILLED LIQUORS.

ALL liquors which have undergone fermentation contain more or less alcohol. This is extracted from them by the process of distillation which has been already described. Each liquor, when distilled, yields an ardent spirit characterized by a peculiar flavor, and is dis-

Difference in distilled liquors.

tinguished by a name of its own. Thus the product obtained by the distillation of wine, cider, etc., is called *brandy*, from fermented molasses, etc., *rum*. *Whiskey* is made from corn, rye, or potatoes, by the following process. The grain or potatoes, after being boiled or mashed, are mixed with a portion of water and barley-malt, and allowed to stand for a while at a temperature which will excite fermentation by the addition of yeast. The mass is then placed in a still, and the spirituous principles separated by heat and condensed by passing through a long pipe immersed in cold water.

Brandy, rum and whiskey.

Gin is a name contracted and corrupted from *Geneva* because originally this liquor was flavored with juniper berries which are called in French, Genèvre. It was first manufactured in Holland and is often termed Hollands, Holland gin, or Schnapps.

Holland gin.

Arrack is a liquor much used in the East Indies. It is made both from rice and the sap of the cocoanut palm.

There are also various *cordials*, such as Noyau, anise seed, Mareschino, etc., which are, to some extent, articles of commerce. But the basis of these liquors is commonly some one of the above spirits, flavored and colored.

Cordials.

Brandy and rum are often impregnated with the juice of the wild or black cherry, and then called cherry bounce or cherry brandy.

The constant use of spirituous liquors is productive of the most injurious effects. The amount of

misery they have caused in the world is incalculable, used as beverages, while they are of immense utility in medicine and science.

They are largely manufactured in the United States, Europe, and indeed almost everywhere. Adulterations are common in them all.

CHAPTER V.

MATERIALS OF CLOTHING.

NEXT in importance to food and drink comes *clothing*. In a rigorous climate human life could not be preserved without it; and the skill and ingenuity of the race, ever since its creation, have been employed in procuring and adapting materials to the supply of this need. Of course they have differed greatly, according to climate, situation, and degree of civilization. But in one form or another the various substances thus used, with their numerous processes of preparation or manufacture, have long sustained one of the most extensive and interesting departments of commerce.

Importance and sources of clothing.

The chief sources from which we obtain the materials of clothing are the *skins of animals*, *wool*, *flax*, *silk*, and *cotton*. In this order they will be briefly examined.

SECTION I.—FURS AND SKINS.

IN a rude state of society, where the arts are unknown, and the climate is severe, men have usually clothed themselves at first with the skins of wild

animals which they have captured, or those of the domestic ones which they have reared. By and by some simple attempts at manufacture appear, and as knowledge, experience, and comfort are gained by these means, improvements are slowly made, till at length commerce comes, bringing the products of foreign skill and science, and very soon the crude appliances of savage life begin to disappear, and barbarism gives way to civilization.

First clothing of men.

Such is the universal range of commerce at the present day, that very few places remain on the globe where the primeval usages of the race in respect to clothing are fully retained. People dress in furs and skins now, to be sure, like the Greenlanders, Esquimaux, and Lapps, because the rigor of the climate where they dwell requires the warmest kind of clothing in order to preserve life. In milder regions, too, furs are worn as an article of comfort in winter, or of expensive ornament. The finer varieties are now among the most costly articles of dress, and are becoming more and more so as the animals which produce them retreat before the advance of the trapper or settler who is pushing his way even into the inclement solitudes where they choose their abode.

Present use of furs and skins.

Costliness of furs.

Furs are the skins of different animals, covered with thick fine hair, the inner side being converted by a peculiar process into a soft leather. Previous to undergoing this process the skins are called *pelts* or *peltry*.

The fur-bearing animals mostly belong to cold or arctic regions, and are so relentlessly pursued by man that some species are rapidly disappearing from the earth. The principal of them are the *beaver*, *fitch*, *sable*, *marten*, *seal*, *nutria*, *muskrat*, *mink*, *sea otter*, *fox* and *bear*.

Principal fur-bearing animals.

The *beaver* is found almost entirely in North America. Its fur is used so extensively in the hat manufacture that it is a very important commercial article. The animal however is becoming more and more scarce. The exportation of fur at present hardly amounts to one-third its former quantity.

Beaver.

The habits of the beaver are very interesting and have been often and fully described. It frequents streams and rivers, forming its habitation beside them with wonderful skill. It feeds chiefly on the bark of the willow, beech and poplar.

Habits of the beaver.

The *muskrat* or *musquash* which is about the size of a small rabbit, has instincts very similar to the beaver, so that the Indians call it his "younger brother." It haunts the banks of streams and is never seen very far from the water, where it swims and dives with great facility, being aided by the webs which connect the hinder toes. It builds a hut of curious construction, plastered with great neatness on the inside, and strengthened without by a kind of basket work of rushes carefully interwoven. Many tunnels branch out from it beneath the surface of the water. Here he lives in winter upon the provisions he has laid up, the snow

Muskrat.

generally concealing his hut from view. But when it melts and the huts appear, (for they are usually built in clusters or villages,) the Indian hunter steals upon them and by driving his four barbed spear through the walls destroys the house and captures its peaceable inmates before they have time to escape through the tunnels into the water. It is also taken with traps. The soft glossy fur of a reddish brown color, is, like that of the beaver, much used in hat-making. It is found in the northern parts of North America.

There are several species of the *marten family*, found in Canada and all over the northern regions of the country, which afford valuable furs. They are allied to the weasel tribes. The *mink* is one of them, and yields a beautiful quality of fur. Efforts have been made in the state of New York to breed the mink in a state of confinement. Some of them have proved quite successful. A visit to a "minkery," where the habits of these pretty little creatures can be watched, is very interesting.

The mink.

Fitch, or the fur of the *polecat*, is principally imported from Germany. It is soft and warm, but has a disagreeable odor.

Many species of the marten family eject, when irritated or alarmed, a fluid of fetid odor, which to some extent impairs the value of the fur in certain markets, as the odor can not be entirely removed.

Fetid furs.

Nutria, sometimes called "neuter skins," are brought from Brazil. The animal is about the size

and shape of a beaver, having a round tail like a rat instead of a flat one like the beaver. It is found along the streams of Brazil.

The more valuable and costly furs, such as the ermine, sable, etc., come principally from Russia, Siberia, and other northern regions of Europe and Asia.

The *ermine* is much less valuable than formerly, when it was thought a fit ornament for robes of state and royalty. The animal which yields it, is considerably larger than the weasel, but resembles it in general appearance. It attains a length of twelve or fourteen inches when fully grown. The fur, in summer, is a reddish brown, which, in the colder regions of Siberia, becomes snow white in winter, with the exception of the tip of the tail, which always remains black. The habits of the ermine are also much like those of the weasel. It lives on small animals, birds, poultry, rats, mice, and even rabbits; for it will not hesitate to attack a prey larger than itself. Siberia produces the finest skins.

Ermine.

The skin of the *sable* is of very great importance in the fur trade, and its commercial value has led to such an incessant persecution of the poor animal that it has gradually been driven into the most inaccessible localities, while the numbers are greatly and constantly diminishing. Formerly a Kamchatkan trapper could easily catch seventy or eighty sables in one winter; but the whole annual produce of all Siberia is stated to be at present, only about forty-five thousand skins.

The sable.

They vary in color as well as in quality. Some have the hair long, close, and of a deep blackish brown, with thick brown underwool. Such are highly valued in St. Petersburg or Moscow, where they bring enormous prices. Others have long dark hair tipped with white; these are also very valuable; but those which are entirely black are considered most precious of all.

Various colors.

A recent writer gives some details of the method of capture. "The chase of the sable is attended with many hardships and dangers. The skins being in the highest perfection at the commencement of winter, the hunters commence their work towards the end of October. In small companies they proceed along the rivers in boats, or travel in sledges to the place appointed for assembling for the winter campaign, carrying provisions for three or four months. In the deep and solitary forests they erect their huts, made of branches of trees, banking the snow around them as a protection from the wind and cold. They now roam and seek everywhere for the traces of the sable, and lay traps or snares for his destruction. These are generally pitfalls, with loose boards placed over them baited with fish or flesh. Fire-arms are seldom used as they damage the skins.

Chase of the sable.

These traps and snares must be often visited at whatever distance apart they may be; and the hunter often finds that a fox has preceded him and destroyed the game already captured. Sometimes a snow-storm overtakes him and he must

retreat to camp to save his own life, abandoning his prey.

Some attention has been paid lately to taming and domesticating the sable. One kept in the palace of the Archbishop of Tobolsk was so tame that it was allowed to roam at large in the town. It showed an intense aversion to cats, and would always manifest a strong desire for a fight raising itself furiously on its hind legs as soon as it saw one. A tame sable.

The *kalan* or *sea otter* is the most valuable of all the Russian fur-bearing animals. The fur is jet black, glossy, soft and thick; and the enormous value set upon it, have induced Russian hunters to follow its traces from Kamchatka to America with such vigor and persistence, that they have nearly extirpated the animal from his haunts on the coasts and islands of Behring's Sea and the North Pacific, where it formerly abounded. Sea otter.

The habits of the sea otter are much like those of the seal. He frequents rocks which are washed by the sea, where he loves to lie basking in the sun. His hind feet are webbed, like those of the goose, which assists him in swimming with great celerity. Habits.

The love of the sea otter for its young is very remarkable. It risks its own life freely to defend or protect them. A naturalist who had the best opportunity to observe the habits of these animals declares that when deprived of their offspring their grief is so great that they soon dwindle to mere skeletons. In flight they carry Love of young.

their young in their mouths or drive them along before them. If they escape their pursuer, they exhibit their delight by a variety of antics.

The sea otter reaches the size of from three to four feet exclusive of the tail. The fur is exceedingly beautiful. The Aleutian islanders are very skilful in capturing them, both on the rocks where they sleep in the sun, and in the water. They live on small fishes and crustaceous animals.

The *seal*, *black fox*, the *bear family*, the *lynx*, the *Siberian hare* and various *squirrels*, likewise produce fur of different values in commerce, as well as many other animals which can not be mentioned for want of space.

Many of the fur-hunters of this country are Indians, who penetrate into the cold regions whither the animals resort. The furs are collected at certain stations of the great Fur Companies, and thrown into commerce, either *dressed* or as *peltry*.

Dressing furs.

The process of dressing furs, consists in placing them when in a dried state, in tubs where they undergo a treading operation with men's feet, until they are sufficiently soft and pliable. If large, they are sewed up, the fur being turned inside. They are greased with butter or lard before treading, which promotes their softening. The fleshy or fatty fragments that adhere are removed, and they are trampled again in tubs containing sawdust; and afterwards with plaster of Paris or whiting sprinkled between the skins. They are finally beaten and combed, which finishes the dressing.

The skins of the bear, wolf, leopard, tiger, buffalo, etc., are used for purposes of warmth or ornament in carriages during winter, and are, like the smaller and more costly varieties, important articles of commerce.

Furs are often dyed to adapt them to prevailing fashions.

LEATHER.

Leather is made of the skins of certain animals, with the hair removed. They have been used for this purpose from remote antiquity, although the best methods of preparing them have been little understood by rude nations.

The raw hides which are converted into leather are procured from the domestic cattle of our own and other countries. Immense supplies are furnished from the wild herds that feed upon the Pampas of South America. They are caught with the lasso, and their skins dried for the market. Hides.

It has been discovered that the soaking of skins in liquors which contain certain astringent properties, has the effect to give them thickness, firmness, and toughness. The astringent principle is called *tannin*, and exists largely in the bark of the oak, hemlock, and some other trees. This bark is peeled off, dried and ground coarsely. After being well steeped in water in pits or vats made for the purpose, the skins, having the hair removed, are plunged in and remain for weeks or months, till they are thoroughly Tanning of leather.

acted upon by the *tannin* of the bark. This process greatly reduces the size of the skin, but hardens and thickens it. When sufficiently tanned, it is taken from the vat, dried, stretched and dressed. *Sole-leather* is made chiefly from the hides of bullocks. Those of the cow and calf are more carefully finished with oil and lampblack as *upper leathers* for boots and shoes, and for many other purposes.

Soft leather.

The softer leathers, such as are made from the skins of sheep, goats, etc., are not impregnated with tan; but the thickening effect is produced by repeatedly soaking them in water where salt and alum have been dissolved. These are often dyed brilliant colors. The skins of the lamb, kid, deer, etc., are used in glove-making, as well as for the manufacture of ladies' boots and shoes.

Boots and shoes.

The leather trade in all its branches is enormous. This country furnishes vast quantities of boots and shoes, which not only supply the home demand, but are sent to the West Indies and other places. The business gives employment to innumerable laborers, men, women and children. Our most extensive manufactories are in the New England and Middle States. In Great Britain and France this trade is very large.

The nicest leather gloves are obtained from France and Germany. The more common qualities are made in this country.

Leather is used in many ways besides in making boots, shoes, gloves, mittens, etc., as articles of

clothing. For the carriage and harness manufacture, for military equipments, book-binding, trunk-making, etc., nothing could supply its place.

Parchment is the skin of the sheep or goat prepared for writing upon, by soaking in a liquor of lime, salt, alum, etc. It is then stretched on a frame, trimmed, scraped, rubbed, and thinned till almost transparent. It was first made at *Pergamos*, a city in Asia, and called pergamenta, which has been corrupted into our word parchment. Parchment.

Vellum is the skin of young calves, treated in a similar way. It is very delicate and beautiful, and like parchment, possesses great durability. Some of the most ancient and curious books known, are written upon vellum. Vellum.

All the fragments of skins, the edges and clippings of vellum and parchment, and other refuse of the hide, are useful in making *glue*. With long boiling all these parts of animal matter become jelly or gelatine, and when dried, harden into glue. Glue.

SECTION II.—WOOL.

THE fleece of the common sheep, llama, alpaca and some species of the goat, furnish in their raw state an article of extensive commerce; the wool trade being carried on very largely both in this and various European countries.

Cloth woven of wool for garments and other uses,

is probably of greater antiquity than that prepared from any other material. The wealth of the ancient patriarchs of Bible times, like that of other wandering people, consisted mainly of flocks and herds, which were driven from place to place to find pasturage; while the large train of dependents subsisted on the milk and meat afforded by them. The business of the women, both mistress and servant, was to prepare the fleece after shearing, and draw out from it upon the distaff, the thread which was to be woven in some rude way as "warp and woof," into cloth.

Antiquity of woven wool.

In very early times this art had attained a good degree of perfection. The Hebrews, Egyptians, Phenicians, Greeks and Romans all understood it, as we know from history, both sacred and profane. They trafficked also not only in wool itself, but in various textures made from it. The toga of the Romans, was a loose robe or gown of fine white wool, and other garments of classic celebrity were of the same material. But the ancient process of cloth making was slow and tedious, and the nice textures too expensive for common use.

Traffic in wool and woolen cloth.

In modern times wool is manufactured by the aid of machinery, and a numberless variety of fabrics of every quality and price, thrown into the market, to be converted into articles of clothing for men, women and children. We can only mention a very few of them.

Modern manufacture.

Great Britain and France furnish to commerce an immense quantity of woolen goods, although

our own country is rapidly improving and perfecting all branches of this manufacture. Broadcloth is now woven at Lowell and other New England mills, equal to any produced in Europe. These cloths are designed especially for men's garments. They are called by this name on account of their width, which exceeds twenty-nine inches. Those of less breadth are named *narrow cloths*.

Broadcloth.

The variety of fabrics formed of wool at the present day is so great, that it would be impossible to enumerate or describe them. Large classes of goods also are made of wool mixed with other articles,—such as cotton, flax or silk. These change frequently in style and texture according to the prevailing mode or taste. Certain kinds of woolen goods however are always in demand such as broadcloths, merinos, flannels, shawls, etc. The first three are too well known to need any description.

Variety of woolen fabrics.

Shawls are made of various materials, in numerous styles, sizes and textures, both in this country and Europe. Wool, hair, silk, cotton, separately or mixed, enter into their construction; and the names which designate the goods are very often taken from the places where they are manufactured.

Shawls.

The finest and richest shawls in the world are those imported from India, and called India or Cashmere shawls, because the city and province of Cashmere, in the northern part of Hindostan, was the original and principal seat of this manu-

facture. They are made of the fine wool or hair of the Thibet goat and are of such exquisite fineness, softness, and beauty, as to bring fabulous prices. But a large portion of those which are sold for real India shawls, are actually made in France; for the Thibet goat was introduced into that country more than thirty years ago and the Cashmere patterns are imitated with great skill. The species of goat which furnishes the wool for them inhabits the mountainous regions of Thibet and Tartary.

The fleece of this goat consists of two very different kinds of fibre, one of which is a fine, soft, rich wool, while the other is a stiff, rough, coarse kind of hair, every fibre of which must be removed before the fine wool can be used in shawl-making. This separation is done by hand and is a tedious process. It is feared that the attempts to naturalize this goat in different countries which are now making, will not be completely successful, as far as the quality of the wool is concerned, for it is never equal to that produced in its native Thibet. The genuine shawl wool, however, has been imported into Europe, and the finest Edinburg and Paisley shawls made of it. But the best imitations of the India shawls can not come into competition with the genuine Cashmeres, which are always preferred.

Fleece of the cashmere goat.

WOOL OF THE LLAMA.

This animal, which inhabits the high table-lands and mountainous regions of Peru, is, in many re-

spects, strikingly like the camel, except that the hump is wanting. It has the same peculiarities of toes and stomach, the same callous spots upon the breast and knees. Its size is about that of the deer, and it is often called the Peruvian camel. To the ancient inhabitants of Peru the llama was what the camel is to the Arabs. They fed upon its flesh and milk, clothing themselves with its skins or with coarse fabrics made from its wool. It served also as a beast of burden, being able to traverse the steep crags and hights where no other animal could keep a foothold. Even at the present day, though superseded by the horse and mule, the llama is considered the most sure-footed of all quadrupeds.

The llama or Peruvian camel.

The wool is long, soft, and silky, and is wrought into a great variety of useful and beautiful textures as well as ornamental trimmings, fringes, tassels, etc.

ALPACA WOOL.

The alpaca is also a native of Peru and other neighboring countries of South America. It is smaller than the llama and bears some resemblance to the sheep, though its neck is longer and its head more finely shaped. The wool is long, fine, of a silky lustre, and varies in color from almost white to black. It is much more pliant than that of the common sheep, and is used in many fabrics which are much worn and highly valued at the present day.

The alpaca or Peruvian sheep.

Attempts have been made within a few years to

introduce the alpaca and establish its breeding in England, but without much success. In 1808 thirty-six of these animals traveled across the whole breadth of South America, from Lima to Buenos Ayres, and were there shipped for Europe as a present to the empress Josephine. But at Cadiz, in Spain, where they were landed, the poor animals were so ill-treated by a rabble that only a few of them survived, which remained in Spain; none of them ever reached the distinguished and unfortunate lady for whom they were designed. Queen Victoria possesses one or two of these animals at Windsor, where are likewise kept a number of Cashmere goats.

The alpaca in Europe.

Fabrics made from this wool are called *alpacas*, and are very glossy and handsome. It is often mixed, the warp being sometimes of cotton or silk, while the weft is of the alpaca wool.

SHODDY.

Within a comparatively few years a new branch of woolen manufacture has grown up and become of much importance. The article referred to is called *shoddy*, and is made either wholly or partly of old woolen refuse and rags, which were once considered as utterly worthless. After being subjected to various softening processes, they are torn to pieces by powerful machinery, and reduced to their original state of wool, which after being *re-spun*, either with or without an admixture of fresh wool, is again woven into cloth.

Shoddy.

Formerly, shoddy was used only for paddings, etc., but now, blankets, druggets, carpets, table covers, etc., are made of it, as well as cloth for the army and navy, pilot cloth, and other fabrics for overcoats; and indeed in some of its various forms almost everybody wears or uses it.

Immense quantities of shoddy cloth are made at Dewsbury, in England, where its manufacture on a large scale was first established. Great improvements have been made recently, not only in the fabric of the cloth, but in the dyes. The beautiful woolen table covers are made wholly of shoddy, being printed by aqua fortis from designs drawn in London and Manchester and cut on wooden blocks.

Improvements in shoddy.

The analogy between this manufacture and that of paper is very noticeable; the vilest and most worthless materials being converted in both cases into beautiful and useful forms; and, though comparatively of recent origin, the business is rapidly extending and improving.

Analogy between shoddy and paper.

FELT.

Felt is a kind of fabric resembling coarse woolen cloth, which is made either of wool, or wool and hair mixed, without weaving. The fur of the hare, rabbit, seal, beaver, and some others, with the wool of the sheep, are the materials chiefly used for making felt. The hair and wool are mixed by an operation called *bowing*, by which the vibrations of a bowstring throw up the loose fibres and allow

them to fall on a table as lightly and evenly as possible. The workman covers the first layer of wool and hair (or wool alone) with a thick cloth slightly moistened, and presses it with his hands moving the hair and wool gently backwards and forwards till the fibres of both are thoroughly interlaced. Another layer is then added and the same process continued till the requisite thickness is obtained. Afterwards it is fulled, dressed, colored, or printed according to the use to be made of it. The nice qualities are much used for hats, the coarser for floor-cloths, etc.

Making felt.

It is said that the felting properties of wool and hair were first discovered by a monk of early times, who had made a long pilgrimage, and for comfort in traveling, had placed a small quantity of wool in his sandals. By the moisture and pressure of his feet it had been formed into a compact mass not again separable into fibres.

Felting properties of hair and wool.

This property depends upon the structure of the fibres of hair and wool; seen under a microscope they appear notched, irregular, and even covered with short spines or projections. These interlace with one another if gently moved and moistened, and thus produce a firm texture, now known as *felt.*

SECTION III.—FLAX AND HEMP.

NEXT to that of wool in antiquity comes the manufacture of *vegetable fibres* into cloth. We read

of "fine twined linen" among the rich and beautiful fabrics employed in the decoration of the Jewish tabernacle. Egypt was famous for the abundance and fineness of its linen, thousands of years ago; some of which comes down to this very day in the wrappings of mummies taken from her catacombs. Enormous quantities must have been used in this process of embalming, for every mummy was enveloped in many folds of cloth comprising a great many yards. Linen was an article of commerce too, the purchasers often being kings and princes. Solomon had linen yarn brought out of Egypt at a high price.

Antiquity of linen manufacture.

The Greeks probably became acquainted with this luxury by their intercourse with the Egyptians, though we do not find any mention made of its use among them in the early ages. The Romans, in conquering the Greeks, learned their arts, and in their turn scattered them through all the numerous countries subjugated by their arms. The English owe to the Romans therefore its introduction into Britain, both as an article of clothing and manufacture; for they taught the barbarous natives to cultivate and prepare the flax, to spin it into thread, and to weave it into cloth.

Medium of transmission to us.

Linen (from the French lin) is made from the fibres of the flax or hemp. The stalks of these plants when fully grown are cut down and placed lengthwise in water where they soften and rot, so that the bark may be readily separated from the rest of the stem. This is done by various processes of

drying, breaking, hackling, etc., till the fibrous portion is quite detached from the waste, and made up into locks of a convenient size for spinning. The color of flax is a well-known brown, and a powerful bleaching process is required to impart that snowy whiteness for which table linens are so admirable. This is done either by chloride of lime, which is a very expeditious method, (though it is thought to impair the strength of the fabric,) or by the slower and safer one of what is called *grass bleaching.* Linen thread is often mixed with cotton or silk in nice and delicate textures.

Making linen.

Russia, Germany, Switzerland, Holland, Scotland, and Ireland, produce linens of various qualities from which our supply is chiefly derived, although in some parts of this country flax is still raised and cloth made. The abundance and cheapness of cotton, however, has rendered it unnecessary as well as unprofitable.

Flax growing countries.

Hemp makes stronger and more durable cloth than flax. The finer qualities are used for sheetings, etc., the coarser for sail-cloths, and other rough purposes.

DAMASK.

This name was originally given to a fabric of silk, richly ornamented with raised patterns representing flowers, fruit, etc. Such goods were first brought from Damascus. It is now applied to various textures on which are woven with figures of this kind. Damasks are manufactured in Great Britain and

other places in Europe. The Irish linen damasks are celebrated for their superior quality. The best are woven in hand looms, though power looms are employed in making the inferior kinds. Table-cloths, napkins, doilies, (from D'Oyley, the name of the first maker,) towels, etc., are made of it, while large quantities of similar stuffs in worsted, or in wool mixed with cotton or silk, are used in covering furniture, and for various kinds of drapery.

Damask.

SECTION IV.—SILK.

SILK was known among the Greeks from the time of the conquest of Persia, by Alexander the Great; and long afterwards supplies were brought to Rome from the same source. But the rapacity of the silk merchants at length became so great that the Emperor, Justinian, becoming indignant at their extortion, contrived after many unsuccessful attempts, to obtain some eggs of the silk worm, and introduced the manufacture into Europe. Greece, Sicily, and Italy soon produced this valuable commodity in large quantities, and continue to do so, though many other places have lately engaged in its culture and manufacture. Lyons in France, is a great mart for silk, and produces some of the richest and most beautiful fabrics in the world. Much raw silk comes to us from China, where the art of producing it has been known for ages.

Introduction of silk into Europe.

The silk-worm, from which this important article is obtained, is a kind of caterpillar about an inch and a half, or two inches in length, of a light color and very voracious.

Its natural food is the leaf of the mulberry, so that it can not be reared in any country where the climate is not warm enough for this tree to flourish. The worms are kept upon frames, placed one above another like shelves, in an airy but warm apartment, and supplied with mulberry leaves upon which they feed night and day till they attain their size and maturity. They then cease to eat and begin to spin their cocoon from a substance contained in two compartments of their bodies, each of which sends out a thread. The worm unites these threads by a peculiar mechanism of its mouth, aided by a gummy substance, and with this it encloses itself in a case or cocoon of an egg shape and a yellowish color. Here it has no motion and seems dead unless you press it, when you perceive by a faint movement that life is still present, though its conditions are so greatly altered.

The silk-worm.

In a few days, if nothing is done to prevent it, a winged insect, or moth, will hatch and gnaw its way through the cocoon. This whitish gray moth is extremely weak and frail, and its single purpose in existence is to lay eggs for a new generation of worms, which develop from them, and in their turn go through all the processes and changes just described.

Moth and eggs.

But if the cocoon is to produce silk, the moth must by no means be suffered to make its way

through, as it would naturally do soon after the worm ceases to spin. The hole made by the insect would divide the thread of silk into so many short pieces that it would be utterly useless. After selecting, therefore, the largest and best cocoons in order to have a sufficient supply of good eggs for the next season, the others, are put into a tolerably hot oven in baskets, and baked gently for about an hour to kill the moth inside.

Destroying the moth.

The cocoons are now ready for use. The coarse web on the outside is carefully removed, and then they are thrown into hot water and whisked about to loosen the ends of the thread. Eight or more of these ends are caught and twisted firmly together to unite them into one. This thread is drawn through a hole in an iron plate, and attached to a reel, which, in turning, draws off the substance of the eight or more cocoons. Care must be taken, if a thread breaks, to join it again, or supply its place with another when expended. The length of the thread varies much in different cocoons. Some of them will measure twelve hundred yards, but in general not more than five or six hundred. In this state it is called raw silk.

Reeling the cocoons.

To make a thread fit for weaving, two or more of the reeled ones are twisted together. This forms the *warp* or lengthwise thread of the web. That which crosses it is called the *tram* or *woof*, and may be more loosely twisted than the warp. The refuse and coarser

Warp and woof.

parts of the cocoon are carded, spun and employed for many purposes under the name of floss silk.

The textures into which silk is woven are innumerable. Only a few of the principal will be mentioned. Plain silk or *lustring*, the kind mostly used for dress, is woven like any plain cloth, the warp and woof appearing equally on the face of it, and giving it a lustre, from which its name is derived. These silks are often called by the names of their manufacturer, or the place where manufactured, or the use to which they are devoted. They are of all colors and qualities.

Lustring.

Satin is made by the woof passing over several threads of the warp at a time, presenting a very smooth and glossy surface. It is one of the most elegant of silk fabrics.

Velvet is made by throwing the threads over a rod of wire. If the wire is simply drawn out leaving an arrangement of *loops*, it is called uncut velvet. If the loops are cut open before the rod is removed the threads spread outwards and cover the entire surface with a rich, fringy coat, soft, smooth, and glossy. Some of the Italian cities, Florence, Genoa and others are noted for the manufacture of velvets. But those made at Lyons are inferior to none.

Velvet.

Ribbons are woven as narrow webs of lustring, satin or velvet;—or these styles are intermingled, in endless variety according to prevailing fashions. Much of this ribbon work is done on little hand looms at the homes of the weavers. Basle, in Switzerland, is noted for its home-made ribbons of elegant quality.

Gauze is a silken web so fine and thin as to be almost transparent. It is used for veils, and trimmings to heavier textures. *Crape* is also made of raw silk stiffened and pressed in a peculiar manner. The Chinese are skilful in manufacturing these fabrics.

Gauze and crape.

Moire antique is a thick and elegant texture of silk which has been passed between *cylinders*, of which one has ridges and the other depressions, producing an unequal pressure upon the goods, and imparting an irregular lustre to the surface. This effect, called watering, can be produced on worsted fabrics as well as silk. Sometimes the goods are moistened, sometimes one roller is heated and the other cold; or both are cold, or both heated, to diversify the impression.

Moire antique.

Moire antique goods are frequently very fashionable, and sometimes not much in demand; but the rich silks thus ornamented are very costly, as well as very beautiful. They have been chiefly produced in France; but at Spitalfields in England the art has been so nicely copied as almost to excel the French manufacturers.

Where made.

Brocade is a heavy silk on which are raised ornaments, flowers, foliage, etc. Formerly the word applied to stuffs woven or enriched with gold and silver thread; but at present all fabrics which have figures or patterns raised and ornamented in this way are termed brocades.

Silk is a very important article of commerce, and its culture and manufacture are receiving much at-

tention in this country as well as in the old world. The great trade in silk consists of the raw material, just as it is reeled from the cocoon. In this state it is taken by manufacturers and converted into any desirable fabric. Much comes from Persia, China and some of the southern countries of Europe.

Silk trade.

SECTION V.—COTTON.

COTTON is a soft downy substance resembling wool, which grows in the capsules or pods of the cotton plant. It has become one of the most important commercial articles in the world.

The cotton plant grows spontaneously in many tropical or warm countries, and it is cultivated more or less extensively in almost all quarters of the globe where the climate allows. In the southern United States of America it is carried to the greatest perfection both in regard to the quality and quantity of the staple produced. In the European countries which lie on the Mediterranean, in China and other parts of Asia, in the West Indies, Brazil, etc., it is grown to a considerable extent, and is an article of commerce; but this country surpasses all others in the cotton culture, and is second to England alone in its manufacture.

The cotton plant.

The method of cultivating cotton differs in differ-

ent places, but in the United States the process is substantially as follows. The ground is thrown up by plowing, into beds ranged in long rows five or six feet apart; a drill or furrow is made on the top by a small plow, and into this drill the cotton seeds are thrown about the last of March or in April, where they germinate very rapidly. When the plants are four or five inches high, they are thinned out and left in single stalks fifteen or twenty inches apart. Here they grow to the general height of from four to six feet, although in the rich bottom lands of Mississippi and Louisiana they often reach nine or ten feet. The flower is large, of a yellow color, with a purple spot near the base. As the seed ripens the capsule splits open and discloses the snow-white fibers which gradually push out of it. During the autumn months the cotton is ready for picking.

Cotton cultivation.

The next process is to clear the fibers from the seed, to which they strongly adhere. This is done by a machine called the cotton gin, a most important invention of Eli Whitney of Connecticut. It consists of toothed cylinders revolving in a direction contrary to one another and worked by horse power. The cotton is placed between these cylinders where the interlocking teeth tear the fibers from the seed. This was formerly done by hand, and was a very slow and tedious process. The invention of the gin created a new era in the history of this valuable staple.

The cotton gin.

After ginning, the cotton is made up into bales weighing several hundred pounds, pressed into an

almost solid state by powerful machinery, and in this form thrown into market. When unpacked and loosened it recovers its lightness.

The whole process of manufacturing cotton is performed by the most ingenious and wonderful machinery, the operation of which may be seen so readily that it is not worth while to spend time in its description. There is hardly a town in New England possessing the requisite water power, which does not resound with the noise of machinery of the cotton or woolen mill. Thus the manufacture gives employment to a great number of people, and at the same time affords the textures at such low prices that all can be well clad in cotton garments. The English are able even to bring the cotton from India, work it up into muslins in their mills, send it back, and sell it in Hindostan, cheaper than the natives can produce it on the spot by hand.

Cotton manufacture.

But machinery can furnish nothing more beautiful for its exquisite fineness and delicacy than the genuine article of India muslin. And those who wear these elegant and costly importations, would perhaps be surprised to see with what rude mechanism the native weaver produces them. He takes the clumsy apparatus which serves for a loom, under the shade of some tree in the open air, and there plies his skilful fingers in the same manner that his father did before him, to make a texture that princesses are proud to wear. The turbans of some Indian princes are made of lengths of muslin so fine and long

India muslins.

as to occupy many years of a weaver's life. And among native ladies of rank, the criterion by which the fineness of the fabric is judged, is the capability of drawing the web through a finger ring. And yet all the operations necessary to its construction are performed with the very rudest implements.

The *spinning jenny* invented by Richard Arkwright of England, is a machiné or engine by which a great many threads can be spun at the same time either of cotton or wool. It consists of a number of spindles connected by bands with a common driving wheel or cylinder; and all revolving simultaneously, produce a thread much more even, thin, and strong than can possibly be made by hand. It has revolutionized all the old methods of spinning.

Spinning jenny.

We have numberless fabrics made from cotton alone and others where it is in combination with wool, silk, flax, etc.

As cotton cloth comes from the loom it is in long webs or cuts, of various width and fineness. Its uses in this form are innumerable; much of it is afterwards bleached and dressed, which makes it nicer for many purposes. Woven in a twilled style, it is called drilling, jean, etc., with a nap raised, cotton flannel. Many other names designate other textures both plain and colored, manufactured both in this and foreign countries.

Sheetings, drillings, flannels, etc.

Calico is cotton cloth printed with colors, and dressed with starch. It is so called because it was first brought from Calicut, a city in Southern

India. It is coarser than most muslins, and makes a very convenient, cheap, and durable article of female dress. Some goods of this class are elegant and expensive. All kinds are too well known to need any description. They are called *prints* or printed cottons as well as calicoes.

Calicoes and prints.

Chintz is a kind of calico ornamented with gay spots or figures, and is used for curtains, coverings for furniture, beds, etc. It was formerly imported from India but is now successfully imitated by the English, Swiss, and others.

Gingham is woven with threads of different colors, in stripes or checks.

Muslin is one of the finest sorts of cloth made from cotton. Some think it derives its name from the French *mousse*, (*foam* or *froth*,) on account of the lightness and delicacy of the goods. Others think the name was derived from the city whence they were first brought, Mossoul, or Mosul, in Asiatic Turkey, on the river Tigris. Muslins are, with us, used as articles of ladies' dress, but in the East they are not confined to this purpose. Indian and Turkish gentlemen often wear them in robes, scarfs, turbans, etc.

Muslin.

Muslins are of various names; *book muslin*, and *Swiss muslin* are both very thin and transparent. Cambric muslin, jaconets, lawns, and cambrics are thicker and more substantial.

Lace is also woven of cotton in webs as a fabric for dress, still lighter and more airy than muslin. This is worn over other rich and elegant fabrics,

such as satin, silk, velvet, etc. The process of making the web-lace is very different from that by which the costly edgings and trimmings are produced. Lace is also woven of silk, in webs, for veils and many other uses. Web-lace.

Cotton fabrics of every description are manufactured in this country, but the French and English perhaps furnish to commerce the greatest quantity.

THREAD.

Thread is of itself a very important article of commerce, from the coarse twine we call packthread, to the gossamer fibre either of cotton, flax, or silk which enters into the most transparent textures coming from the hand of the lace maker or embroiderer. Thread of cotton, silk and flax.

The material designed for thread, is spun as evenly as possible, and as many single cords put together as will make it of the requisite size and strength. This is indicated as two, four, six cord, etc. These are twisted firmly together and sometimes stiffened or glazed. Thread is wound by machinery on spools and numbered according to its fineness. That designed for the sewing-machine is prepared with extra care. Sewing silk is knotted into small skeins and sold by weight, as well as wound upon spools.

Linen thread is used where the greatest strength is required, as in the sewing of leather, carpets, etc., as well as where the utmost delicacy is needed, as in lace-making.

Thread is manufactured on a great scale in many places in this country and Europe.

ORNAMENTAL LACE.

This delicate fabric composed of a network of fine threads of cotton, linen, silk, etc., is of great antiquity. The name is from the Latin *lacinia*, which means the hem, fringe, or border of a garment; and is in itself a presumptive evidence that it was known to the Romans, who doubtless derived it from the Greeks. It was not probably the beautiful and costly tissue which now goes by that name.

Antiquity of lace.

Lace trimmings and edges are made in many places in Europe, and give employment to thousands of women and children. The various names applied to them to indicate the kind, which is generally known either by the place of its manufacture or the particular method of its working.

Thread lace (sometimes called *pillow* or *bone lace*) is made by placing a perforated pattern upon a hard stuffed pillow or cushion, and working the tissue over it with bobbins of bone or ivory and pins, in a manner too complicated for a brief description. *Honiton lace* differs from the above by having the pattern made separately. The honiton lace district extends about thirty miles along the coast of Devonshire in England, and about twelve miles inland. Many thousands of persons are employed in its manufacture.

Thread lace.

The most celebrated laces are the *Brussels*, made

in that city and neighborhood; *Mechlin*, made in the city of that name, and also at Antwerp, Malines, and other towns in Belgium. *Valenciennes*, made in various places in France, besides the city which originally gave it a name; *Lisle* and *Alençon*, made in those cities in France and their environs. New styles or patterns arise from time to time, taking generally the name of the place where they are first manufactured, as Cluny, etc.

Celebrated laces and where made.

France takes the lead in lace-making, although Belgium is her great rival. Many of the novelties in the art originate in Merecourt in France. *Point d'Alençon*, perhaps the most exquisite of all the varieties of lace, is made of pure linen hand-spun thread, with a *needle* instead of bobbins. This thread prepared all ready for the work, is worth from five hundred to six hundred dollars a pound. *Point lace* was formerly made in convents, stitch by stitch, and is a very slow and laborious process.

Point d'Alençon.

British point lace, *tambour* and *Limerick laces* are chiefly imitations, but often very handsome and expensive. The application of machinery to some branches of lace-making has produced a variety of cheap articles some of which are very pretty, and closely imitate the more costly kinds.

Imitations, and machine lace.

Lace trimmings are made of silk and cotton thread, as well as linen. *Gold and silver lace* for the richest and most elegant decorations, is woven with the warp of silk and the woof covered with

gold or silver wire, flattened, and wound around the thread by machinery. It thus becomes a smooth, resplendent cord, which may be employed not only in weaving but for embroidery and other uses where the most magnificent ornamentation is required.

Materials used in lace-making.

Lace is a very extensive article of commerce both in its dearer and cheaper varieties. It comes to us in great quantities from France, Belgium and England. There are a few places in this country where lace of the ordinary kinds is woven; and quite recently the manufacture of the genuine bone lace has been commenced by experienced workers from France and Belgium.

Lace in commerce.

The light nature of the goods themselves and the heavy duties laid upon them have led to much smuggling of laces between one country and another. Many ingenious and amusing modes have been devised for the successful evasion of custom house dues, which add so materially to the cost of these beautiful fabrics.

Smuggling of lace.

TRIMMINGS.

Although lace holds the first place as an ornament for dress, yet there are many other articles which are used for this purpose from time to time as fashion or taste may dictate. We can barely mention a few of them, commencing with *embroideries*. The nicest embroidery on muslins, etc., is done with the needle and

Embroideries.

makes the daily labor of great numbers of poor women in the British Islands and other European countries, for which they receive a very small compensation. The varieties are innumerable, and the styles change constantly as in other devices for ornament. The art is very ancient and has been applied to all sorts of materials.

Gimps, *fringes*, *tassels*, *cords*, *braids*, etc., are all well known and too common, as well as too diverse to need description. Very many of them come from France, whose fertile invention, for a long time past, has not only furnished the fashions themselves, but the materials for conforming to them. Other trimmings.

Beads have figured very conspicuously from time to time either as appendages of use, or as ornaments to certain articles of dress. They are made of various shapes, sizes and substances. Those of gold or silver were formerly much valued as decorations for the neck. By Catholics they are used for devotional purposes, strung into rosaries; and are often made of amber or other precious material. Among savage or barbarous people, like the American Indians, beads were used not only as ornaments for belts, moccasins, etc., but as *money*, which they called *wampum*. They were made of small shells, or of the teeth of animals perforated to admit the string. In many of the mounds at the West and South, these beads are still found with the other treasures of the dead warrior, which were buried with him according to the custom of the race. Beads.

But the beads best known to trade, because most frequently in fashion, are made of glass, either colored or transparent; black being the hue generally preferred. They are of every size and are used separately, or combined with other materials as trimmings.

Glass beads and bugles.

Bugles are cylinder-shaped beads of various sizes employed for the same purpose. Both are highly ornamental, and are often used together.

The market for beads and bugles is mostly supplied from the centre and south of Europe. Venice and some cities in Germany manufacture them on a great scale and furnish them to commerce whenever the fashions demand this species of ornament.

Buttons are articles of essential utility to the dress of men, women and children, but they are also used for ornamental purposes. They are made of various metals, wood, gutta-percha, horn, porcelain, pearl, glass, and other substances. Many are covered with silk, velvet, thread, beads, etc., and are of endless variety in size, shape, and design. Many kinds are made by complicated machinery and in immense quantities, both in this country and Europe. The button manufacture gives employment to great numbers of workmen and women.

Buttons.

SECTION VI.—HATS, CAPS, GLOVES AND HOSE.

Hats for men and boys are made of beaver and other furs, felt, silk, cloth, straws of various kinds, the palmetto leaf, chip, cane, bamboo, etc.

Beaver hats are the nicest and most expensive. They are made (when genuine) of the fur of the beaver, matted or entangled into a clothy substance which is called felt. The hat goes through many processes and manipulations before it is brought into the proper shape. It is then dressed, lined, finished, brushed, etc., till ready for sale. Common *felt hats* composed of cheaper fur and wool, are made in the same manner. *Silk hats* have an outside covering of floss silk over a frame of pasteboard or some stiff substance. They have, when nicely made, a beautiful lustre.

Beaver and felt hats.

Cloth hats are a cheap variety, made of some thick woolen cloth, and mostly worn by boys. They are flexible and bear crumpling, like the soft felt hats. Cloth hats for summer wear are of lighter materials.

The hats of straw, chip, etc., both for men and women, are mostly plaited and sewed into the right shape. They retain the color of the material, or are dyed, as taste and fashion require. The *palmetto hats* are braided throughout. Some of the finest straws are imported, as the Leghorn and Florence, from those cities in

Other materials.

Italy, but great numbers are made in this country, of the rye straw cut while the grain is green, and bleached. In many sections of the country, girls and women produce the common braids which are sewed, dyed, and finished by the manufacturers. Ornamental and fancy braids are mostly woven.

Caps are made of fur, felt, cloth, etc., and are designed entirely for men and boys.

Ladies' hats.

Some of the materials just mentioned are used also in making hats for ladies. Beaver riding hats were formerly worn more than at present; but numerous styles in felt and straw demand the same skill and labor to produce them. The shapes and trimmings however differ widely.

Artificial flowers.

The trade in *artificial flowers* is mainly kept up by their use as ornaments to ladies' hats and head-dresses. This exquisite art, now carried to such a degree of perfection, was first practiced by the Italians; but the French have been most ingenious and successful in it. And there are now scarcely any of the forms and colors of flowers, grass, grains, fruit and leaves, which are not accurately imitated in silk, crape, velvet, feathers, paper, etc., producing resemblances to nature of extraordinary accuracy and beauty.

Gloves are made of various materials according to the use for which they are designed. Leather gloves are made of the skin of the seal, deer, sheep, kid, chamois, and other animals. The skin is prepared in such a manner as to be soft and pliable without being tanned. Nice gloves are made of

kid and other delicate skins dyed of various colors. There are many places in Europe where gloves of superior quality are made, particularly in France, Germany and Ireland. The *names* of certain manufacturers vouch for the excellence and durability of their goods. *Gauntlets* are gloves with long wrists. Anciently they were worn by knights in armor, composed of jointed steel plates to protect the hand and arm. *Throwing down the gauntlet* was a challenge to single combat. Taking it up was accepting the challenge.

Gloves and gauntlets.

Mittens are made of yarn, knitted, or of buck-skin or other leather stitched with a needle. Many of these are produced in New England. In very cold places the fur of the skin is turned inside. *Mitts* are made of silk netting and designed only partially to cover the hand.

Mittens and mitts.

Hosiery of all kinds is now made by machinery. It is either woven, or knitted in a machine for the purpose, recently invented. The articles are not so durable as those produced by hand, but their cheapness ensures an immense market. The best hose are of English manufacture. A similar process produces that fabric called *stockinet*, of which under garments are made.

Hosiery.

CHAPTER VI.

ARTICLES OF HOUSEHOLD USE AND ORNAMENT.

SECTION I.—CARPETS.

CARPETS of some sort have been in use from very ancient times. In Egypt, India and China, both carpets and rugs were manufactured at a very remote period, and allusion is made to them in Persian, Grecian, and Roman history. Originally they were designed for sitting or reclining upon, as is still the case in Eastern countries, where they constitute the principal furniture of an apartment. In Egypt they were first applied to religious purposes in the temples; afterwards they were employed to garnish the palaces of the Pharaohs. On the tomb of Cyrus, as we read, was spread a purple Babylonian carpet, and another covered the bed whereon his body was laid.

Ancient use of carpets.

Carpets were not known in Europe to any extent before the twelfth century. Thomas à Becket of England, a celebrated Archbishop of Canterbury, was noted for his splendid style of living, and it is mentioned as an illustration of it, that the sumptuous apartments of his palace were strewn every day

in winter with *fresh straw or hay.* This was about A. D. 1160.

The art of carpet weaving was introduced into France from Persia in the reign of Henry IV., between the years 1589 and 1610, where it flourished extensively, and supplied to the neighboring countries some of its richest fabrics. But the oppressions and exactions practiced upon the working classes tended at length to discourage the business. Certain artisans who had become disgusted with their condition in France, went to England and established a carpet manufactory in 1740, near London. Since that time improvements have been constantly taking place, until the process seems brought to perfection in the famous Axminster, Wilton, Kidderminster and Brussels varieties, now produced from English looms; to say nothing of the splendid imitations of Turkey and Persian carpets, and the wonderful tapestries which can only be afforded by those whose revenue is princely.

Introduction of the art into France and England.

Carpets are composed wholly or partly of wool, woven in a peculiar manner after a pattern so divided into squares, that the workman can see what color and how many threads are required at every step of his labor. The application of machinery to the art, thereby saving an incalculable amount of time and toil, has diminished the cost of these useful fabrics. At the present day we see the floors even of the industrious poor covered by some description of carpet.

Extensive use of carpets.

The cheapest and thinnest of commercial carpets

is the *ingrain* or *two-ply;* which is woven with *two webs* of different colors, whose threads interlace and form figures according to the pattern; alike on both sides, except that the colors are reversed, so that the figure which is light on one side is dark on the other, and the contrary. They are often very handsome and durable.

Ingrain or two-ply carpets.

Those carpets which are composed of *three webs*, where the threads interchange in the same manner as the ingrain, are called *three-ply*, and are very thick and heavy. In both of these kinds, the warp and weft, or woof, are of wool, except in those of very mean quality, where the warp is of cotton.

Three-ply carpets.

But in the *Brussels* and other rich carpets the foundation is of strong linen or hempen cord, and the wool raised above it by inserting a series of wires or rods between the linen foundation and superficial yarn. When these wires are pulled out, it leaves the yarn in loops, like uncut velvet. Brussels carpets were first introduced into Wilton, in England, more than a century ago, from Belgium. Kidderminster is now the chief seat of this manufacture, where upwards of two thousand looms are in operation.

Brussels carpets.

Axminster and *Wilton*, or velvet carpets, are both imitations of Turkey carpets. They are woven much like Brussels, and differ only in this, that the loops are cut open into an elastic velvet pile. To effect this, the wires are not circular as in the Brussels

Velvet carpets, Axminster, Wilton, etc.

fabric, but flat and made with a groove in the upper edge, where the sharp point of a knife is inserted and drawn across the yarn cutting the pile. These carpets are made in many parts of England, Scotland, France and Belgium. They are also manufactured to a considerable extent in New England, particularly in Massachusetts and Connecticut.

TAPESTRY.

Tapestry is a kind of embroidered or woven fabric, originally designed for hangings, and made of wool or silk, sometimes enriched with gold and silver raised work. The designs represent figures of various kinds, flowers, animals, landscapes, historical events, portraits, etc. Tapestry.

The art was introduced into England in the reign of Henry VIII., though there were manufactories in Flanders long before. But in France it has been brought to the highest state of perfection at the famous establishment of the Gobelins, in the city of Paris. It derived its name from certain celebrated dyers who settled and carried on their business in this place about the middle of the fifteenth century. They introduced into Paris that beautiful scarlet color which has since borne their name. Several generations of this family made large fortunes by the art which they understood so well; and from them is named the royal manufactory of the Hotel des Gobelins, which was established by Louis XIV. The rich and costly fabric since known as *Gobelin tapestry* Gobelin tapestry.

is made here. It has been used for a long time to adorn the palaces of the sovereigns of France. The splendor of the colors, the beauty of the designs and workmanship are indescribable. They must be seen to be appreciated. Many of the pieces illustrate historical subjects; some are copied from costly paintings while some patterns are designed specially for the purpose, by celebrated artists. The portraits are astonishing, for perfection of features and coloring.*

Slow process of making tapestry.

The process of making tapestry is slow and laborious, although less so than formerly; for though it is a species of weaving, it is closely allied to needle-work, and is done mostly by hand in looms of very simple construction. It sometimes requires the labor of from two to six years to finish a single piece; and the cost of them, which is enormous, is regulated less by the size, than by the beauty and difficulty of the work.

Turkey, Persian and India carpets

Turkey, *Persian* and *India carpets* are made by hand among native families and tribes. The work is mostly done by knotting into the warp, tuft after tuft of woolen yarn in patterns more or less complicated. Real Persian carpets are usually very small, not much larger than

*Since the above was written, this ancient and celebrated establishment has suffered irreparable injury if not destruction, at the hands of lawless masses of the French population during the current year (1871). Whole workshops with their machinery, including the valuable collection of tapestries from the time of Louis XIV. to the present day, being lost or destroyed. Many of the pieces were very old and kept for exhibition.

hearth rugs, long and narrow, and for this reason the trade in them is very limited.

Many improvements and novelties have been recently introduced into the manufacture of carpets, tapestries, etc., and machinery is gradually superseding the slow processes of hand work;* producing imitations of the Oriental styles which even rival them in beauty and richness. Improvements in the manufacture.

Rugs are small carpets woven with the yarn in long fringes for warmth, or like the velvet carpets, for ornament. They are also made in a variety of styles by hand.

Numerous other sorts of carpets might be mentioned, but these are the principal of the commercial varieties. Many home-made carpets are very pretty, and extremely comfortable and durable; but they are not articles of commerce, or only to a very limited extent. Home-made carpets.

Druggets, *bockings*, *feltings*, etc., are coarse cloths, mostly of wool, for the covering and protection of carpets. They are sometimes made in patterns of various sizes, and surrounded with a printed border. Others are in lengths, printed in colors on the upper side, and sewed in breadths like carpeting. Druggets, bockings, etc.

Straw matting is used extensively in place of carpets in warm climates, and even in colder ones in the warm season. They are cool, neat and agreeable for this purpose. Straw matting.

FLOOR OR OIL-CLOTH.

Floor or oil-cloth.

This useful and ornamental manufacture originated in England, about the year 1740. It was at first made by sewing narrow canvas together, to which successive coats of paint were applied. But the seams proving inconvenient, a canvas was woven for the purpose varying in breadth.

Mode of preparing it.

This cloth is stretched upon frames, and first rubbed over with pumice stone, which renders the surface smooth and even. Then it is brushed over with a weak size, to stiffen it. When this is dry, the first coat of oil color is laid on—not with a brush, as in painting, but with a kind of trowel, something in the manner of plastering. After this is well dried, a second coat follows, and a third, till seven coats are applied, three on the under, and four on the upper surface. It is now of one color, and, when sufficiently dry, is ready for the pattern. To apply this, the cloth is removed from its frame upon a large roller, and carried to the upper part of the building, where the figure is printed upon it by wooden blocks, on which the patterns are cut. While drying it is suspended so as to hang perfectly free; as rolling or doubling would injure it. It is now ready for market.

The value of the finished cloth is mainly estimated by its weight, compared with the naked canvas. It is an article in constant demand, being used more or less in almost every well-furnished house, office, etc.

In some European and Oriental countries, the floors of fine public or private buildings are not covered, but ornamented with mosaic patterns, laid in marble, porphyry or other beautiful stones, often producing a very magnificent appearance. Some of less pretension have floors laid in ornamental woods, presenting very elegant effects. This style is adopted in many private residences in this and other countries at the present day. Other uncovered floors are waxed, painted or varnished.

Mosaic floors.

It is said that carpets of some kind are more generally in use among the English and Americans than any other people.

SECTION II.—FEATHERS.

Feathers of different kinds make a considerable article of commerce, particularly those used for beds. These are mostly obtained from the goose, duck, swan and other birds adapted to the water. Those of the goose, however, are chiefly depended on for this purpose. Many parts of Great Britain supply these feathers for commerce. Geese are kept in great numbers, and are deprived of their feathers several times a year, fresh ones growing out in place of those plucked from the poor birds, only to be torn from them again, to supply the demand for *live*

Live geese feathers.

geese feathers. Such as are taken from the dead bird are thought to have a disagreeable odor.

EIDER-DOWN.

The soft and valuable article, called *eider-down*, is procured from the nests of the eider-duck, during the breeding season. In Greenland, Iceland, Norway, Scotland, and other northern countries, these birds associate in vast flocks, having favorite localities, usually on small islands near the shore, to which they resort year after year. Here they construct nests so close to each other that in some places it is difficult for a man to walk among them without crushing some of the eggs. The duck pulls the down from her breast to line the nest and cover the eggs. The inhabitants watch them, and visit the nests frequently, to remove the down, which is as often replaced, till the duck has deprived herself entirely of the warm covering of her breast. Her mate, the drake, then contributes his, which is taken away in the same manner. About half a pound of this down is thus obtained from each nest. It combines with a peculiar lightness, softness, and fineness, so great a degree of elasticity, that a quantity of it which might be compressed and concealed between two hands, will serve to stuff a small coverlet.

Eider-down.

A very interesting account of the eider-duck is given by Mr. Shepherd among many pleasant descriptions of travel in Iceland.

"This duck," he says, "holds the very first rank

among the useful birds of Iceland. Its chief breeding-places are small flat islands on various parts of the coast, where it is safe from the attacks of the arctic fox. These breeding-places are private property, and have, some of them, descended from generation to generation in the same family and have proved a rare source of wealth."

Shepherd's account of the eider-duck.

There are very strict laws for the protection of these birds in Iceland; killing them or stealing the down is punished severely. Proprietors of certain small islands frequented by them, reside alone among their feathered tenants, and during the breeding season allow no visitors to land without special permission. All noise, shouting or loud speaking is prohibited, it being of the first importance not to frighten the ducks, as they will readily forsake a locality where they are frequently disturbed. Materials, like hay or straw, supplied for the construction of the nests, will sometimes induce them to leave one island for another. The female lays five or six greenish eggs in a nest lined with her beautiful down which the collectors remove, lifting the duck from her nest, and afterwards replacing her, when she soon begins to lay again though this time only three or four eggs. These and the down are also removed and she has her labor to perform the third time, assisted by the down of the drake, her own having been exhausted. Two or three eggs are now allowed her to hatch, the rest having been pickled for winter use.

Habits of the eider-duck.

The island of Vigr, on the north of Iceland, and one of the head-quarters of the eider-duck is occasionally visited by travelers. It is represented as affording a most wonderful sight in the breeding season of these birds. "The ducks and their nests were everywhere," says Shepherd; "some even piled in heaps on one another. The solitary farm-house occupied by the good woman who owned the island was also thronged with ducks. The base of wall that surrounded it, and that of the building itself was fringed with ducks setting upon their nests. The window-seats were occupied by ducks; on the turf slopes of the roof were ducks; and a duck sat in the scraper at the door. A grassy bank near by had been cut into squares of about eight or ten inches, and a hollow made in each. These were all filled with ducks, as were the out-buildings, mounds, rocks and crevices. Many were so tame as to allow themselves to be stroked on their nests; and the kind woman who had charge of them said that there was scarcely a duck on the island that would not allow her to take its eggs without fear or flight. Her careful guardianship has added largely to the amount of down annually obtained from the island."

Ducks of the island of Vigr.

These birds are of considerable size; the drake white, or much lighter colored than the duck, which is brown. The down is used largely for making coverlets, the warmth and lightness of which are unequalled.

Swan's down is also valuable in commerce. It is sometimes prepared upon the skin of the bird, and

used for a trimming. Large supplies of this down, as well as other superior feathers, are obtained from Dantzic.

Many kinds of feathers are used entirely for ornamental purposes. Those of the ostrich, peacock, heron, bird of paradise, pheasant, etc., are of this class. Ostrich feathers have been held in the highest estimation from very ancient times, and have furnished decorations for the head-dress of ladies, the helmets of warriors, etc. Ornamental feathers.

The *ostrich* is a native of Africa. It is a very large bird, and incapable of flight, although it runs with great speed. It is hunted wholly for its plumage, which consists of the long, loose feathers on the wings and tail. It is captured with great care, to prevent injury to them. The feathers are sorted into various qualities, cleansed, bleached, scraped, curled, and sometimes dyed to adapt them to various uses. Some of them are naturally white, some black, some gray; but means have been devised to impart brilliant colors to them, even different shades to the same feather; either contrasted, or blending with one another. Plumes of the ostrich.

Besides the ostrich, several other birds afford very beautiful feathers. The *marabout*, *ibis*, *rhea*, *egret*, and many more, which are not generally known, but whose plumage comes occasionally into fashion. The peacock rivals all other birds for the splendor of its hues. The feathers are sometimes worn for ornament, but oftener made into elegant fly-brushes, fans, etc. Other birds.

The ancient Mexicans and Peruvians had an art, now lost, of embroidering with feathers, or applying them in some way, so as to produce garments of amazing brilliancy and beauty.

SECTION III.—PORCELAIN AND POTTERY.

Porcelain or *China* ware is the finest and most delicate kind of earthen ware. The first specimens of this manufacture were brought to Europe from China and Japan. The Portuguese who brought it, called it *porcelain*, from *porcella*, which, in that language, means a cup. It is composed of very pure, white clay, finely pulverized silica or flint, and a little lime. The utmost care is used in mixing these ingredients, and removing every impurity. When ready for working, the mixture has the appearance of dough. It is formed into various articles, upon a peculiar kind of lathe, or shaped in moulds of plaster of Paris. After drying, it is baked in kilns, or ovens, for many hours. The intense heat would vitrify the flint, and make it transparent; but the clay is incapable of fusion, and by being everywhere intermingled with the flint, prevents this effect. Both together make it assume the fine and delicate appearance so much admired.

Materials and manufacture of porcelain.

When the ware is removed from the kiln it is called *biscuit*. It is now compact and solid, but

still so porous that water will filter through it This is remedied by glazing, which is done by dipping the ware into a cream made of materials similar to its substance, only much thinner and more fusible. The ware takes up the glaze, the water sinks into the biscuit, and the powdered flint of the cream remains spread evenly on the surface. Another heating fuses the powder into a glossy covering over the entire article. In ornamented porcelain, the designs are printed or painted on the surface before glazing, with metallic substances that develop their color after fusion with the glaze. In some cases the various colors in the painting are put on separately, and each color fixed by heat before the next is applied. The gilding is done by a solution of gold mixed with quicksilver and ground up with oil, laid on with a camel's hair pencil. In the oven the gold fastens to the porcelain, and the quicksilver is evaporated. The gilding at first is dull, but is afterwards burnished. Other methods and styles of finish are used, and improvements are constantly made in the details of this manufacture.

Biscuit.

Glazing of porcelain.

Ornamenting of porcelain.

Parian, of which statuettes and other ornamental articles are made which resemble fine marble, is a carefully prepared variety of porcelain.

The various processes in the manufacture of fine porcelain were known only to the Chinese till within a comparatively recent period. Early in the last century a French Jesuit, who had become acquainted with the art

Introduction of the art into Europe.

by a residence in that empire, gave an account of it in a letter to some of his countrymen; and this information, in connection with the chemical investigations of certain learned men, led the way to the establishment of the manufacture in Europe. It was first commenced at Dresden, in Saxony, which has been famous ever since for the beauty of its productions. Italy, Germany, England and other countries now produce beautiful and valuable varieties of porcelain; but the finest and most magnificent specimens of European china are produced at Sevres in France; in the manufactory carried on at the expense of the French government.

Sevres china.

In this country there are several establishments and the business is rapidly increasing. Porcelain earth is found in abundance in various parts of the United States.

Common *stone* and *earthen ware* are made much in the same way as porcelain, only with less pains taken, both in the materials and their manufacture. The glazing of very coarse articles is sometimes done by throwing salt into the oven where they are baked, which instantly becomes vapor and fixes in a glossy polish upon the ware. For nicer qualities a glaze much like that for porcelain is used.

Stone and earthen ware.

WEDGWOOD OR QUEEN'S WARE AND POTTERY.

The art of making pottery and brick is very ancient. The Egyptians, Chinese, Hebrews, Greeks,

etc., practiced it from time immemorial. The Greeks probably learned it of the Egyptians and from them it found its way to the European countries, as many other arts did after the conquest of Greece by the Romans.

Antiquity of pottery.

At Etruria, in Tuscany, the art made such advances that Etruscan workmanship became famous. Some admirable specimens of this pottery preserved in the British museum, first suggested to Mr. Wedgwood of England, the idea of imitating it. The idea resulted in the invention of a new ware called *Wedgwood or Queen's ware*, which has had for many years a widespread and well-deserved popularity; while its extensive establishments have employed thousands of people and produced vast quantities and varieties of ware which have been exported to every quarter of the globe.

Wedgwood ware.

The principal materials for pottery, as for porcelain, are clay and flint, each finely pulverized. Clay alone will make brick by burning, but it will not work into thin walls for drinking vessels, etc., without cracking. For coarser purposes, such as flower pots, jugs, and jars of various kinds, which are made quite thick, it needs little besides the clay and the glazing; but for the nicer vessels, the mixture with flint is indispensable. When made into a tough paste with water, it is either shaped by the wheel or by pressing into moulds. After the articles are formed, they are dried by a gentle heat before being subjected

Common pottery.

to the higher temperature of the kiln or oven; they are then glazed.

Very rude and barbarous nations have known and practiced the art of making coarse vessels with baked or sun-dried clay. Fragments, and some entire articles are found in ancient tombs or other burial-places, such as urns, vases, etc., which are of very great antiquity and are very interesting and curious objects.

Color of brick and pottery.

The red color of bricks and common pottery is owing to the iron combined with the clay, of which they are composed. Some kinds of clay do not contain it, and then the articles made from it are light colored.

Terra cotta.

Terra cotta is a kind of pottery, made of clay and hardened by heat, which is used for statues, figures, vases, architectural decorations, and the like. The name in Italian means baked clay or earth.

Plaster of Paris.

Plaster of Paris or *gypsum* is a mineral, consisting mainly of sulphate of lime. Some kinds are transparent, and then they are called *selenite*. The thicker and more massive varieties constitute *alabaster*. When calcined or burnt, it is reduced to a fine powder, and becomes what is called plaster of Paris, because originally obtained from Montmartre, a village near Paris. When mixed with water it is used for casts, moldings, and various ornamental purposes. The name is often incorrectly given to the stone before calcination. It is then properly gypsum—after calcining, it is plaster of Paris.

SECTION IV.—GLASS-WARE.

GLASS is made by mixing together some sort of siliceous substance, such as fine sand, or pounded flint, with an alkali, such as soda, potash, etc., and subjecting them to a strong heat. By this means they are melted into a transparent, soft, tenacious mass, that may, when hot, be formed into thin plates, or bent and shaped in every possible way. When cool it becomes hard and brittle.

Materials of glass.

The manufacture of glass is one of the very highest beauty and utility; and it is probable that we are indebted for it to the Phenicians and Egyptians. The story is told of its accidental discovery by pirates who landed on a sea-beach, and wishing to cook food in their caldron, piled dried sea-weed for fuel, on a collection of flinty pebbles which they found at hand. After their repast they discovered in the ashes lumps of a strange transparent appearance, which proved to be the first specimens of true *glass;* the sea-weed having furnished the alkali, and the pebbles, the siliceous or flinty material. The tale no doubt is fabulous like many others which have attempted to account for discovery of the art of glass-making. There is every reason to believe that it had its origin at the same time with the baking of bricks and pottery, which was practiced by the Egyptians long before the Hebrews were held in bondage by them. The priests of Vulcan at Thebes and Memphis were

Origin of the art of glass-making.

the greatest chemists of the ancient world; and some authors ascribe the invention to them. The art, at any rate, is very ancient, as is proved by the fact that glass beads and other ornaments, skilfully manufactured, and beautifully colored, have been found upon mummies which are known to be upwards of 3,000 years old.

Tyre, Sidon, and Alexandria, were also celebrated for their glass, and furnished the greater portion of that used in their traffic. Under the Roman Empire the Egyptians still preserved their superiority in this art, and it is said that Aurelian compelled them to pay their tribute in that article. After awhile the manufacture itself was introduced into Italy, and thence into other parts of Europe. But so rare and costly was it, that for centuries, objects made of glass were used only as articles of luxury, to be displayed on grand occasions, and laid away with other royal or princely treasures. For the urns, drinking-vessels, etc., which were so exquisitely embellished by raised, chased, or other ornamental work, (now quite unknown in many of its elaborate and curious processes) might well be the pride of kings.

Diffusion of the art.

The celebrated *Portland vase*, which was found in the tomb of Alexander Severus, and is now in the possession of the Duke of Portland, in England, is composed of deep blue glass, with figures of a delicate white substance, raised in relief, and is a splendid specimen of Egyptian art.

Portland vase.

Glass utensils have also been found in Herculaneum, a city of Italy, destroyed in the year A. D. 79, by an eruption of Mount Vesuvius. Beads and amulets of colored glass, and of exquisite workmanship, have been found in various Druidical monuments in England, Stonehenge and others, from which some have supposed that the ancient Britons understood the art of glass-working before the conquest of the country by the Romans. But it is more probable that the Britons obtained these ornaments by traffic with the Phenicians or Syrians. They seem to have been used for religious purposes alone, and probably played an important part in the rites and ceremonies of the Druids.

Ancient specimens of glass.

The Venetians were long pre-eminent in the art of glass-making, in Europe. During the thirteenth century they were the only people who could fabricate mirrors of large size, and all the European courts were obliged to buy of them. But the art found its way into France and England, and the Venetians lost the monopoly. It long since spread into other European countries; and at present is in successful operation in many places in the United States.

Venetian glass.

Glass is known in market by different names. *Flint-glass* is so called because it was made formerly with pulverized flints. It contains an ingredient of lead oxyd, which gives it a beautiful transparency. It is employed for the lenses of optical instruments, prisms, chandelier drops, and is the basis of the artificial

Flint glass.

gems known as *paste*, which are colored by metallic oxyds to resemble various precious stones.

Crown-glass.

Crown-glass, or common white colorless glass, is that which is used for common window-glass, looking-glasses, tumblers, goblets, and a great variety of articles for the table. The celebrated Bohemian glass, the finest made, is of this kind.

Plate-glass.

Plate-glass is that which is used in making mirrors and for very large window-panes. It is quite expensive, and is made by pouring the melted materials upon a flat surface of copper with ledges at the sides to keep it in. Afterwards it is made of even thickness by a heavy roller. When it is cold the plate is ground on both sides and then polished with emery and putty, till the surfaces are entirely smooth. It is now ready to be annealed, and to receive a thin coat of quicksilver, when it becomes a mirror.

To anneal a plate of glass, is to bring it so near the fire as to almost melt it a second time, and then remove it slowly so that it shall cool very gradually. This prevents brittleness; otherwise it would break with the slightest stroke.

Making a mirror.

The silvering of a mirror is done by placing a sheet of tin-foil on a smooth stone table; quicksilver is poured upon it till the foil is completely covered; the plate of glass is then placed upon the quicksilver and pressed down with weights. After remaining thus for several days, the quicksilver and foil combine, and the mixture cleaves firmly to the glass.

Bottle-glass is the coarsest and cheapest of all the varieties, and is made of refuse materials. It is often very dark colored and almost opaque.

The whole process of glass manufacture is very curious and interesting, and no longer invested with the mystery which once attached to it. The materials are mixed in different proportions according to the use for which the glass is designed, and fused, or melted together in a large furnace under an intense heat. This furnace is usually in the form of a truncated cone with the fire at the centre, and around the circumference melting-pots, from which the workmen supply themselves for making articles of infinite variety. Some blow from an iron pipe the end of which has been dipped in the melted glass, a large bubble, which is flattened out for window-glass or shaped into a vessel; as a goblet, tumbler, or vase. Others with a small quantity blow into a mold, making a bottle, of which the neck is shaped with an iron instrument.

Making glass.

But the numberless forms of use and beauty into which this material is thrown by the skill and dexterity of workmen, are quite beyond description or imagination.

Glass may be colored by adding, while in a melted state, small quantities of metallic substances, called oxyds, which dissolve in it without affecting its transparency. Some of these substances impart one color, and some another; and if the glass be very hard and fine, many of the precious gems can be closely imi-

Colored glass.

tated by it. Thousands of very beautiful ornaments, as well as articles of use, are made of colored glass.

Enamel is the name given to glass which is rendered milk white and opaque by the addition of an oxyd of tin. Watch dials, and what are called porcelain transparencies, are examples of such enamels. Colored enamels may also be produced by introducing the different metallic oxyds into the white enamel.

Enamel.

Glass, in all forms, is a very extensive and important article of commerce, and is manufactured in many places, and on a large scale, both in Europe and in this country. The pure, white sand which is necessary, is found in many localities, but is by no means common. The finest in the world is said to be obtained among the Green Mountains of Western Massachusetts, large quantities of which are annually exported to Europe.

Green mountain sand.

We are indebted to this art for a vast amount of household comfort and convenience, as our mirrors, our pictures, our vases, our windows, might constantly remind us; and the fact that some of the commonest substances in nature *can*, by skill and science, be converted into a material so useful and ornamental, should excite both wonder and gratitude in every reflecting mind.

Value of glass.

CHAPTER VII.

USEFUL AND ORNAMENTAL WOODS.

OAK.

BEFORE all the forest trees which yield products of timber to commerce, should be placed the *oak;* for without its tough sinews to impart strength to our vessels, commerce could scarcely go on; at least with distant countries which are only reached by long and often dangerous voyages. The wood of the oak is the best and most durable known; and therefore is used where great strength and resistance is required. Some kinds of timber are harder than others, some more difficult to rend, and some less capable of being broken across; but none combines all the three qualities in so great and equal proportion as the oak; and thus, for at once supporting a weight, resisting a strain, and not splintering by a cannon-shot, the timber of the oak is superior to every other.

The oak.

The majestic appearance, sturdy growth, and dense leafy crown of this noble tree are so familiar that description would be superfluous. Standing single or in groves the oak adds beauty and attractiveness to any landscape.

There are several varieties of the tree common to temperate climates, but the English oak claims precedence of every other. It is remarkable for the stoutness of its limbs. The color of the wood is a fine brown of different shades, well known to every one; and it is used in the building and finishing of land structures as well as for ships.

Varieties of oak.

The *white oak* abounds in the northern sections of the United States, the *live oak* in the southern. The durability of the latter is said to surpass that of the European oak.

Besides its use in house and ship-building, much account is made of its bark by the tanner. The acorns of some species serve for the food of pigs, while the galls or excrescences which others produce are employed in dyeing, and ink-making. Immense quantities of oak timber are exported from the Northern and Middle States.

Other use of the oak.

PINE.

The *pine*, or *fir* tree stands next to the oak in point of utility and value. There are more than twenty species, mostly evergreens; and generally the timber is best in cold and exposed situations, where its growth is slow. Norway, Sweden, Russia, Denmark, produce enormous quantities of pine timber from their immense forests, which is exported to various countries, under the name of Scotch fir. In the United States, the *white pine*, *red Canadian pine*,

Varieties of pine.

yellow pine, *pitch pine*, and the *lablolly*, or *old field pine*, occupy the various sections of the country, and produce abundant supplies of excellent timber, both for home use, and export. The *white pine* is the loftiest of all our forest trees, and its timber is used in much greater quantities, and for a greater variety of purposes, than any other. Besides its unlimited use in building, it furnishes for export much timber for masts of ships. Maine produces a large proportion of all the white pine lumber exported from the United States.

White pine.

The *long-leaved pine*, which flourishes along the coast, is the one which furnishes most of the pitch, tar, and turpentine consumed and exported by the United States. Its timber is also valuable and enduring.

Turpentine is the resinous juice of the pine, which is obtained by making incisions, or rather, excavations, in the trunk of the tree, near the ground, which will contain about a quart. These are made in the winter, when the juice does not flow. Early in the spring it commences, and continues through the warm season. As the cavities fill, the liquid is removed from them into casks, where it thickens into a soft, solid state. It is now ready for market. Some of the juice hardens before reaching the receptacle for it, and is scraped off, and put in barrels for sale, under the name of *scrapings*.

Turpentine.

Spirit, or *oil of turpentine*, is prepared by distilling the juice, either with alcohol or water.

After distillation, there is left a brownish, resinous mass, brittle, capable of being melted, highly inflammable, and is insoluble in water. This is the common *rosin* of commerce.

Rosin.

Tar is an article of great commercial importance. It is a thick, black, ropy substance, chiefly obtained from the pine, and other turpentine trees, by the following process: A cavity is made in the ground, generally in the side of a bank, or sloping hill, and within it pine wood, roots, etc., cut in convenient length, are piled up in a conical shape, and then covered with earth, beaten and stamped down, to render it as firm as possible above the wood, and keep out the air. The pile is then fired, and burns with a slow combustion, without flame, as in making charcoal. During this combustion, the tar exudes, and falls into a cast iron pan, placed in the bottom of the cavity. This pan has a spout which projects through the side of the bank, and as the tar flows out through it, barrels are placed to receive it, which, when filled, are bunged up, and ready for immediate exportation.

Tar.

Pitch is the substance left after the distillation of tar, an oil passing off called *oil of tar*, from which a number of curious and important products are derived by chemical processes.

One of these is *creosote*, which possesses such remarkable properties for preserving meat. It is also used in medicine.

Paraffine, another of them, closely resembles spermaceti in appearance. It is a white, partially

transparent, crystalline substance, without taste, or odor, obtained by distillation from this oil. It melts at about 118° Fahrenheit, and is much used in making candles. In a liquid state, it is also very serviceable for lubricating machinery, and for other purposes. A species of tar is also obtained from hard wood, and still another from coal.

CEDAR.

There are many varieties of wood called *cedar* which grow abundantly in both continents. The *cedar of Lebanon*, famous in Scripture for its great size, durability and beauty, is the most celebrated. The wood was anciently used in the construction of temples and other public buildings, in making images, and for various useful and ornamental purposes. Very few of these trees remain on the mountains of Lebanon, where they were once so plenty, but these few are of gigantic growth, and though so very old, still in excellent preservation. The *red cedar* is the species best known in this country, of which it is a native. It thrives in the Southern States and the West India Islands. The wood is of a dark reddish color, has a strong odor, and is not liable to be attacked by worms. It is employed principally in the manufacture of chests, drawers, wardrobes and the like, with a view to prevent the inroads of moths. It is also much used in making lead pencils. The wood is of a nearly uniform texture, brittle and light.

Cedar of Lebanon.

Red cedar.

CHESTNUT.

The American *chestnut* tree sometimes reaches the hight of seventy or eighty feet. The wood is strong, elastic and durable. It is used much for posts, rails, shingles, and also in making chamber furniture, and as an ornamental wood in interior finishing. It takes a high polish, and in contrast with woods of darker color, like black walnut, it has a very elegant effect.

Chestnut.

The tree also grows in the south of Europe, where the nuts are much esteemed as an article of food.

MAPLE.

Rock maple or sugar maple is the name given to one of the most noble and majestic of American trees. It does not usually exceed fifty or sixty feet in hight, with a diameter of twelve to eighteen inches. The grain is fine and close, and when polished it has a silky lustre. It is much used for cabinet work, chairs, etc.

Rock maple.

The wood of this tree sometimes exhibits very curious forms in the arrangement of its fibre, of which cabinet-makers take advantage in manufacturing some of the most elegant articles of furniture, such as bedsteads, secretaries, writing-desks, etc., and for inlaying the mahogany and black walnut of bureaus, side-boards, piano-fortes, and other ornamental work. That which goes by the name of *curled* and *bird's-eye* maple, exhibits beautiful spots and shades

Curled and bird's-eye maple.

which greatly increase the value of the wood. This singular appearance is never found in young trees, but in those which are old and sound. Before mahogany became so common in the United States, the best and richest furniture was made of the maple, which in lustre often exceeded the imported woods.

Another common use to which the curled maple is applied is the manufacture of the stocks of rifles and fowling-pieces.

The *sap of the rock maple* is much used in making sugar; the peculiar flavor rendering it a great favorite, especially in the spring when it is first made. By age its taste is much impaired. A *coloring matter* is also obtained from the bark of the tree. Other products of the maple.

WALNUT.

There are several varieties of the *walnut* tree, but the white and black are the principal. The tree is said to be a native of Persia, and the countries bordering on the Caspian sea, but it is now abundant in both hemispheres. Walnut wood. It is a tree with strong, spreading branches, and very extensively used in making furniture; especially the *black walnut*, which is adapted to a great variety of useful and ornamental purposes. Large quantities are converted into the stocks of muskets, as it is superior to every other wood for this object.

The common white walnut, or hickory, is a very serviceable wood, and is employed in making agri-

cultural implements, handles of tools, etc. It is very strong and durable.

The nuts of the walnut have always been held in high estimation. They are either gathered when ripe, for eating, or picked when green and pickled, or used in catchup and table sauces, to which they impart an agreeable flavor.

TEAK.

The *teak*, or *Indian oak*, is a large forest tree, that grows in dry and elevated regions in the south of India, and some of the adjacent islands. It is said to have qualities for ship-building almost equal to the oak, and is used for that purpose. Ships built of it are nearly indestructible by ordinary wear, and instances are frequent of their having lasted eighty or one hundred years. The teak of Malabar is considered the best. At Maulmain, in India, a great number of vessels are annually constructed of this timber. It is also exported to Calcutta and Madras, for the same purpose.

Teak.

PALM.

This order of trees, which contains many varieties, is found in most tropical countries of the globe. That which produces the cocoa-nut is the most common. Linnæus calls the palms the "princes of the vegetable kingdom," as well for their stately appearance, as for the number and diversity of their products, such as wine, oil, sago, sugar; to

which might be added, thread, utensils, weapons, food, and habitations. The natives of some Oriental countries, where this valuable tree flourishes, have enumerated *eighty* distinct uses to which it is appropriated. The timber of the palm is employed where it grows, for building purposes, in situations where no great strength is required. The leaves serve for thatching, matting, baskets, and many other uses. Those of the palmetto make durable and substantial hats. The common *canes, or ratans*, are the flexible stems of a curious species of creeping palm, which luxuriates in the forests of tropical Asia. Sometimes their slender stems, armed at the joints with strong spines, climb to the tops of the highest trees, where their leaves expand in the sunshine. Sometimes they run along the ground, rendering the forest an impenetrable tangle, through which a path must be hewn with the hatchet. These rope-like plants frequently grow to the length of four or six hundred feet, consisting of hundreds of joints, each bearing a feathery leaf with thorns on its lower surface. They may often be seen two hundred feet long, and an inch in diameter, without a single irregularity, and destitute of all appearance of foliage, except a tuft of graceful leaves at the extremity. The natives of Java, and the neighboring islands, cut the canes into fine slips, which they manufacture into mats, baskets, cordage, etc. Divided into convenient length, they are also exported to Europe and America, where they are used for chair seats and

Palm.

Canes, or ratans.

backs, carriage sides, and a great variety of work in which strength and lightness are desirable. The *bamboo* is sometimes confounded with the cane, or ratan, but it belongs to an entirely different order of plants, though used for many similar purposes. The bamboo is, strictly speaking, a gigantic sort of grass with a woody stem. It grows everywhere within the tropics, and often rivals in hight the loftiest trees of the forest. The stems of these gigantic grasses, called *culms*, grow with an unexampled rapidity, averaging in favorable locations an inch in an hour. In New Grenada and Ecuador, a species named *guadua* ranks next to the sugar-cane and maize, in usefulness to man. The culms attain a thickness of six inches; the joints are twenty inches long, and the leaves of great beauty. A whole hut can be built and thatched with this plant, while water vessels and other articles of household convenience are made from the single joints.

Bamboo.

But the real bamboo is found chiefly in India, Southern China, and the Eastern Archipelago, where it grows in a variety of genera and species, both on the high and low lands. It forms the impenetrable jungles where lurk wild beasts and deadly serpents. Sometimes a hundred culms spring from a single root, not seldom of the thickness of a man's body, and towering to the hight of eighty or ninety feet.

The variety of uses to which these enormous reeds are applied, almost equal those of the cocoa-nut palm. The Chinese are exceedingly ingenious in adapting them to all sorts of work, either of

utility or beauty. They split the culm through its whole length, into very thin pieces, and twist them into cordage for the towing of their boats or the rigging of their junks. They build their houses and construct their furniture of it; mats, screens, chairs, tables, bedsteads, besides many ornamental objects. Of the young shoots, fine writing paper is made. In Mysore and Orizza the seeds of several species are eaten for food, either with or without cooking. In Java the prickly bamboo, which is of such flinty hardness that sparks are emitted when struck with an axe, is used to form impenetrable hedges.

Uses of the bamboo.

MAHOGANY.

This is a tree which grows abundantly in the West Indies and Central America. It is one of the most majestic and beautiful of trees; its trunk is often forty feet in length and six in diameter. It divides into so many massive branches, and throws its shade over such an extent of surface, that few more magnificent objects are to be met with in the vegetable world.

The tree.

The wood is imported from Honduras and Campeachy and also from the West India islands, in the form of logs varying in length and thickness; these are squared with the axe before shipping, and are cut up into veneers by manufacturers and dealers.

The wood.

Mahogany is a very beautiful and valuable wood. Its prevailing color is a red brown, of different

shades, and various degrees of brightness; sometimes yellowish brown, veined and mottled with darker shades of the same color. Several names are applied to it, such as plain, veined, watered, festooned, etc., designating the variety. It is very hard and strong, takes a beautiful polish, and is admirably adapted to cabinet work.

Obtaining the timber.

The process of obtaining the trees is one of great labor and difficulty especially if they are at a considerable distance from the coast. They are felled and hauled with oxen to some stream if possible, so that at the periodical swell which occurs in the rainy season, they may be floated down to the wharves of the proprietors, whence they can be shipped. The heat is so great that some of the labor is done in the night, as neither men nor beasts are able to endure the burning rays of the sun during the excessive toil of transporting the logs to the water.

Value of the logs.

The value of some of these logs may be estimated from the fact that a firm of piano-forte manufacturers in London paid not long since, the sum of three thousand pounds sterling, (over thirteen thousand dollars) for three logs of mahogany. These logs were the produce of a *single tree*, and were each about fifteen feet long and thirty-eight inches square. They were cut into veneers of eight to an inch. Another extraordinary specimen of this splendid tree was felled in British Honduras, October, 1823, which weighed more than seven tons, and cost when landed at Liverpool, over £375; here it was sold

for more than £500, and the expense of sawing amounted to £750 more; so that the wood of this one tree before passing into the hands of the manufacturer, was worth more than seven thousand dollars. Much of the wood, however, is not so valuable; the best grows on dry rocky soils, and in exposed places. It is not so much used at the present day as formerly; other ornamental woods having become more fashionable. But very few of them compare with it in solidity, fineness of grain, color, and susceptibility of polish.

ROSE-WOOD.

This elegant wood derives its name from its fragrance which is thought to resemble the rose. It is a product of several tropical regions—China, Siam, the Canary Isles, etc., but the principal supplies come from Brazil, where it grows abundantly. Its hardness, fine grain, and rich shades adapt it to the nicest cabinet work. The logs average about twenty-two inches square, and are cut into veneers of nine to the inch. It is much used for piano-fortes, and is exceedingly beautiful and brilliant.

Rose-wood.

EBONY.

Ebony wood is brought principally from the East. Ceylon, Madagascar, Mauritius, and some other places produce the tree. The wood is very hard and heavy, susceptible of a fine polish,

Ebony.

and is much used in mosaic and inlaid work. There are several kinds; black, red, green, but the black is much preferred to any other. The centre of the tree is the valuable part.

Ebony is not so much in demand as it once was, substitutes for it having been obtained by coloring other woods. It is at present but an inconsiderable article of commerce.

LIGNUM-VITÆ.

This tree is a native of the West Indies. It is a very hardy evergreen, and grows to a considerable size, striking its roots so deeply into the ground as to defy both the hurricane and the drouth. The bark is hard, smooth and brittle; the wood of yellowish, or olive color. It is the heaviest and most difficult of all the woods to work, as it can scarcely be split, but breaks into pieces like stone. Being full of a resinous juice, it will imbibe neither oil nor water, and is therefore proof against decay.

Lignum-vitæ.

This wood, from its weight and hardness, is adapted to use in various ways where these qualities are needed. Stampers' mallets, pulley-blocks, rollers, etc., are made of it. By tapping the living tree a resin is obtained, which is the *gum guaicum* of commerce, much employed in medicine. It is found in the tropical regions of America.

BOX-WOOD.

The *box* tree is a native of the middle and southern portions of Europe. It grows also abundantly

in the United States, where it is often called dog-wood. This tree was much admired by the ancient Romans, and has been extensively cultivated in modern times on account of the facility with which it is cut into fantastic shapes. Box-wood. The wood is of a yellowish color, hard and heavy, capable of receiving a fine polish, and is very durable. It is much used by turners, carvers, engravers on wood, and for mathematical and musical instruments. In France it serves for combs, knife-handles, button-moulds, etc. Large supplies are annually sent to that country from Spain.

Box is the wood mostly used by the engravers of wood cuts for illustrations in books, etc. By this means the cost of such embellishments is much reduced. The picture to be engraved is first drawn on the box-wood block, and Wood-cuts. then cut into it by suitable instruments, so that the lights and shades shall be properly presented when it is moistened with ink and impressed upon the paper. The wood is so hard that it admits of as fine and sharp finish as any metal, and if care is taken to preserve the blocks from injury, they will print an incredible number of copies. The art has attained great perfection.

SANDAL-WOOD.

This is the wood of a tree having somewhat the appearance of a large myrtle. It is of a yellow color and yields a peculiar, but agreeable perfume. It grows in some of the South sea islands, Fiji and

others; but the chief supplies are from Malabar and some of the neighboring islands, whence it reaches China and Hindostan. In the latter country it is much used as a perfume in funeral ceremonies. But the Chinese are its principal consumers. They manufacture it into fans and other small articles of use or ornament, and sometimes use it powdered, as a cosmetic. It grows chiefly on rocky hills, and if permitted would reach a considerable size, but from its great value is cut down when comparatively small. The tree is beautiful, with regular and tapering branches, a leaf somewhat like that of the willow, but shorter and softer. The blossoms are small, hanging in clusters, and are either red or white, according to the color of the wood. It is one of the most valuable productions of the Malabar coast.

Sandal-wood.

The tree when cut down is usually about nine inches in diameter at the root, but sometimes considerably more. It is barked and cut up into billets, and then buried in a dry place for about two months, during which time the white ants eat off the outer wood without touching the heart, which is the true sandal. It is then taken up, and when sorted, is ready for market. That which is of the deepest color and nearest the root is considered the best. It is seldom brought to Europe or this country, except by individuals for their own use, or as presents to friends, but is an article of commerce between countries in the East.

Preparation of the wood.

CORK TREE.

The tree which produces this useful substance is a species of *oak* which flourishes in Spain and the south of Europe generally. Cork.
The bark of the tree is the valuable part which is obtained by cutting down through it lengthwise, and then stripping it from the tree in sheets.

The trees should be ten or fifteen years old before the bark is fit for peeling. This process does not injure the tree, as the new bark which grows every year would push off the old coat if it were not thus removed. These sheets are put under water and made flat by placing heavy weights upon them while soaking. Preparation of cork.
They are afterwards dried and then are ready for use. The broad flat pieces, four or five feet long and eighteen or twenty inches wide, are cut up by hand or machinery into various sized corks. The adaptation of machinery to this business is a very great improvement, as it was long done entirely by hand with sharp knives.

Cork was anciently used as floats to nets, soles to shoes, and various domestic purposes quite different from those to which it is now principally applied; for the Greek, Roman, and other antique vessels had mouths too large to be stopped in this way. It was the invention of glass vessels with narrow necks, which brought Uses of cork.
cork into general use, and it has now become a necessity everywhere. Good cork is very compressible and elastic, and fills the space into which it

is forced so completely that neither water nor air can pass through. The best are called velvet corks.

SATIN-WOOD.

The *satin-wood* is among the most valuable of the timber trees of Ceylon for size and durability. The forests in many parts of the island are thickly set with this fine tree, so that the traveler rides under its ample shade for days together. It grows to the hight of a hundred feet, with a ragged gray bark, brilliant green foliage, and small, white flowers with an odor not particularly agreeable.

Satin-wood.

The weight of the wood is such that it is cut mostly near the banks of rivers or streams, down which it can be floated to the coast, where it is shipped. The richly colored and feathery pieces are used for cabinet work, and the more ordinary logs for building purposes. The floors of the houses in Ceylon and other parts of India are commonly made of this wood.

CHAPTER VIII.

METALS.

SECTION I.—PRECIOUS METALS.

THE noble or precious metals are *gold*, *silver*, *mercury* and *platinum*. There are a few others which are classed with these, but they are obtainable only in such small quantities that they are unknown to commerce, and are practically of no importance.

GOLD.

Gold, the most precious of all the metals, has been known from the earliest antiquity; and next to iron it is the most widely diffused over the earth. It is found in the oldest rocks, and in sands derived from them, generally in the form of thin scales or grains, sometimes in large nodules, weighing many pounds, and sometimes as crystals. Native gold is always alloyed with silver in greater or less quantities. Gold.

Gold is a metal of beautiful appearance, a reddish yellow color, and a high lustre. When pure it is nearly as soft as lead. It is the most malleable of all substances, and may be beaten out into leaves

which do not exceed $\frac{1}{200000}$ of an inch in thickness. It does not rust, and is not corroded by simple acids. *Aqua regia*, a powerful acid composed of two others chemically mixed, will dissolve it.

This metal is sometimes found in mines, but more frequently in the sands of rivers, which are washed, sifted and worked in various ways to obtain it. If it is contained in rock, the rock is broken up, ground and sifted. Quicksilver is mingled with the sand thus pulverized, which by its strong affinity for gold, attaches to it, and amalgamates with it. The earthy matter is then washed away, leaving the gold and quicksilver combined. By heating, the latter is driven away, and the pure gold remains. This can then be melted into bars, or ingots, and becomes a commercial standard of value by which to compare and regulate that of other property.

Obtaining gold from ore or sand.

Gold, to some extent, is a product of almost every country of the globe. In *Europe* there are mines in Hungary, Sweden, Russia and Spain; while the sands of many rivers are rich in precious grains. In *Asia*, especially in its southern districts, there are many mines, as well as streams, rivers and sand-wastes which contain this metal. Japan, Ceylon, Java, Sumatra, the Phillippines, and many other islands afford it. *Africa* and *Spain* were the countries whence came most of the gold possessed by the ancients. But while the Spanish mines are now

Foreign sources of gold.

scarcely worth working, gold continues to come from Africa, chiefly in the form of dust, brought from interior districts in the quills of the ostrich or vulture.

Many places on this continent yield large quantities of gold. In South America, Brazil and Chili are renowned for mines and veins of this precious substance, as well as for numerous streams containing it. Mexico and other provinces of Central America furnish it, and many portions of the United States, particularly the Carolinas and Georgia which formerly yielded a considerable quantity. But since the discovery of the inexhaustible supplies in California and other regions in the western part of the country, the labor of mining and digging has been confined largely to that section; and immense quantities of treasure have found their way into the commerce of the world, while towns, cities, and states, have sprung up on our western frontiers like magic, in consequence of the tide of emigration setting toward the gold regions.

American gold.

Australia, too, has still more recently unlocked her golden stores, and thither emigrants and adventurers are flocking by thousands to secure their share of the treasure so freely lavished on that vast and distant island.

Australia.

The yield of gold from both these latter sources, has been unprecedented, so that the principal supplies of this metal have lately been derived from them. The California deposits were discovered in 1848, those of Australia in 1851. Since then gold

to the amount of many millions of dollars has annually been obtained from each. New localities are discovered from time to time.

Both gold and silver find their way into market in the form of bars or ingots, into which they are cast when separated from the ore. This is called *bullion*, and is received at the mint for coining. It is alloyed with about ten per cent. of copper for this purpose.

Bullion.

The method of determining the amount of pure gold or silver in a given mass of metal is called *assaying*. It is done by several chemical processes.

Gold leaf is made by first forging the gold into plates, and rolling them into thin ribbons by means of steel rollers. The ribbon is then divided into small squares and placed between leaves or sheets of what is called gold-beater's skin, (which is a membrane obtained from the intestines of certain animals,) and beaten with a heavy hammer. As the pieces expand they are divided and sub-divided until the required thinness is obtained. One grain of gold can thus be made to cover fifty-six square inches. Silver is beaten out in the same manner, and both metals can also be drawn into fine wire. This latter property of metals is called *ductility*.

Gold leaf.

Besides its use in coin among all nations, gold is employed variously in the arts. It is manufactured into ornaments of every description, and used as a setting for the most precious gems. It is alloyed more or less for these purposes, as it is too soft in a perfectly pure state, and the

Uses of gold.

metals mixed with it (silver or copper) give it strength and durability.

The quantity of pure gold contained in a given mass is expressed by the word *carat*, used in reference to a certain standard number; which number in the United States is twenty-four. Perfectly pure gold is said to be twenty-four carats fine. When, therefore, gold is spoken of as eighteen, twenty, or twenty-two carats fine, it is understood how much it lacks of being pure; or in other words, how much alloy it contains.

Pure gold.

SILVER.

This metal, next in value to gold, is of a fine white color, a brilliant lustre, softer than copper, but harder than gold. It is obtained from mines which exist in many countries of the Old World, Norway, Sweden, Hungary, Spain and Germany. But the most extensive and productive mines of silver are in Mexico and South America, particularly those of Potosi, one of the high ridges of the Andes, in Bolivia. These mines are said to have been accidentally discovered by an Indian while pursuing wild goats upon the mountains. In climbing, he seized a shrub, which gave way and disclosed to his view a mass of silver. For more than three hundred years they have yielded a rich reward to the labors of the miner. The supply of silver seems absolutely inexhaustible from this source.

Silver mines.

The mountain of Potosi, where the mines are

situated, is about eighteen miles in circumference, of a shape somewhat conical, and is composed of a kind of slate which contains quartz rock in abundance. In this rock the silver ore is intermingled, and is obtained from it by crushing and reducing the quartz to a fine powder, and then introducing quicksilver, which unites with the silver, copper, and gold diffused in the sand. The quicksilver is afterwards driven off by heat, as in the treatment of gold; the remaining metal is cast into ingots for exportation.

Mines of Potosi.

Obtaining metal from the ore.

The want of proper machinery for clearing the water from the mines, and the immense waste of quicksilver in the process of amalgamation, or separating the metals from the ore, have proved the greatest obstacles to the profitable working of these and other mines, both in South America and Mexico. Although some quicksilver mines were known in Peru, and have since been discovered in other localities of the New World, the chief supplies of this metal for mining purposes, came from Spain, and at such a cost as essentially to impair the profits of the business. But skill and science are overcoming these difficulties, by constructing proper implements of labor, by devising new methods of operation, and by economizing and utilizing time and materials.

Difficulties in silver mining.

Silver is sometimes found nearly pure in masses; it is then called *native*. But more commonly it is mixed with other metals, copper, lead, antimony, etc. Pure silver, on account of its softness, is not

used to any extent in the arts. It is alloyed with copper in certain proportions, which increases its hardness, without altering its color or brilliancy, and thus renders it less liable to be worn by use. Silver coin in this country, like gold, contains nine-tenths of pure metal, and one-tenth alloy. In England and France the government regulates the purity of silver used in the manufacture of plate, as well as coin, but that is not done in the United States.

Alloying of silver.

The numerous uses to which this beautiful metal is appropriated (besides money) need not be specified, as they are well known to every one. The process of plating, or coating other metals with silver through the agency of galvanic electricity, has reached a wonderful degree of perfection, and supplies thousands of beautiful articles for domestic use, at a cost greatly reduced from that of solid plate. The particulars of this process, both for gold, silver and other metals, belong to the science of chemistry.

Silver plating.

Silver is dissolved by certain acids, of which nitric acid is the most powerful. The substance called *nitrate of silver*, or *lunar caustic*, is made by dissolving silver in this acid, and evaporating the solution to dryness, by which crystals are left behind. These are *salts of silver*, and are cast, by fusing, into slender sticks, which are much used in medicine and surgery.

Nitrate of silver, or lunar caustic.

Nitrate of silver, diluted with water, stains animal substances, and others, an indelible black. It is much used in dyes, and otherwise in the arts.

MERCURY OR QUICKSILVER.

Properties of quicksilver.

This is a brilliant, silver-white metal, of great weight, which possesses the extraordinary property of remaining in a *fluid* state at ordinary temperatures. It will freeze however, at 39° below zero, when it becomes malleable like lead; or will boil at 620°, yielding an invisible vapor.

Cinnabar and vermilion.

Quicksilver is sometimes found native, in a fluid state, but generally combined with sulphur, having the appearance of a reddish stone. In this state it is called *cinnabar*, from which the metal is extracted by a kind of distillation. Cinnabar can be produced artificially by combining sulphur with quicksilver and heating the mixture red hot. A red cake is the result which is cinnabar; and this cake when reduced to powder is known in commerce as the color *vermilion*.

Mines of quicksilver.

The principal European mines of quicksilver are those of Almaden, near Cordova, in Spain, Idria, a town of Carniola in Austria, and certain localities in Hungary and Italy. In the New World it is found in Peru and some other parts of South America, in Mexico and California. The Austrian mines at Idria, like that of Potosi, is said to have been discovered by a fortunate accident.

Quicksilver is imported into this country from Spain, and from Trieste in Austria. It generally comes in iron flasks containing about seventy-six

pounds. Large quantities are consumed in the extraction of silver and gold from their ores, as has already been noticed. The preparation of vermilion, the silvering of mirrors, the construction of thermometers and barometers, and its various uses in medicine employ this metal in vast amounts and in numerous ways. Use of quicksilver.

Since the discovery of its abundance in California, large quantities are exported to other countries.

PLATINUM.

Platinum is a metal of comparatively recent discovery and is by no means abundant. It is always found native, usually in the form of small flattened grains, but sometimes in larger masses; and is obtained from the sand with which it is always mingled, by washing. Some of the principal localities where it is procured, are the western slope of the Ural mountains in Russia, Brazil, and the island of Borneo. Its color is a grayish white, with less brilliance than silver. It possesses great tenacity, and can be drawn out into wire, or beaten into thin leaves like gold. Platinum.

But the most valuable property of platinum is its power of resisting heat. This is so great that it has been exposed to the intense heat of a glass furnace for several days without undergoing any change. The blowpipe or voltaic battery alone, can produce a temperature high enough to melt it. This property ren- Infusibility of platinum.

ders it very useful in chemical apparatus which is to be exposed to great heat.

Platinum is used by dentists in the construction of artificial teeth, as it is never corroded. In Russia an attempt was made several years ago to coin it, but the experiment proved unsatisfactory, and the idea was abandoned. The value of crude or unwrought platinum is about half that of gold. In a manufactured state it is worth nearly or quite as much. It is the heaviest of all the metals.

Use and value of platinum.

SECTION II.—USEFUL METALS.

IRON.

IRON is the most abundant as well as the most useful of all metals. It enters into the structure of both animals and vegetables, and is contained in almost all earthy or mineral substances. In fact this metal is so interwoven with the wants of mankind, that the amount of it consumed by a nation may be taken as an index of its advance in civilization.

Iron.

Iron is sometimes found pure, in small quantities, but oftener in combination with other substances, from which it must be separated by heat. Mines of iron are found in most countries of the globe, and the supply seems inexhaustible.

Pure and combined.

This metal appears in market under several forms,

distinguished by appropriate names, the most important of which are *cast* or *pig-iron*, *wrought* or *malleable iron*, and *steel*. Cast or pig-iron is obtained by the process called *smelting*. The ore, brought from the mine in reddish stony lumps, is introduced into a furnace called a blast-furnace, in connection with coal, which is to fuse it, and a certain quantity of lime, which is to render the earthy matters fluid, so that they will melt away from the metal. This *slag*, as it is called, together with the melted iron, flows down to the bottom of the furnace. But the metal being the heaviest, sinks lower than the slag, which floats upon the surface of the melted mass, and may be raked off through apertures contrived for the purpose. The iron is drawn off at a lower level, and is made to run into rude molds of sand, where it cools. This is *crude cast iron*, or the *pig-iron* of commerce.

Varieties of iron.

Smelting of iron.

Pig-iron.

As the contents of the blast-furnace are removed from below, or consumed, fresh materials are supplied from above, in alternate layers of ore and coal, and the smelting goes on day and night for years sometimes, or until the furnace is out of repair. Strong currents of air are forced into the furnace through a number of blast-pipes at its base, to support the combustion of the coal, and produce the intense heat necessary to reduce the ore. Formerly it was the practice to use the air at its natural temperature. This was called *cold blast;* but more recently it is

Cold and hot blast.

heated to about 500° Fahrenheit before it is introduced into the furnace. This is called *hot blast*, and has a great advantage over the old mode.

The pig or cast-iron is very hard and brittle, incapable of being wrought on the anvil or drawn out into bars. There are two commercial varieties of it, known as *white* and *gray* iron. *White iron* has a brilliant, silvery-white lustre, is very brittle, and so hard that it cannot be worked with steel tools. It is used with advantage in making wrought, or bar iron, and steel. *Gray iron* has a darker lustre, is less crystalline in structure, much softer, and may be filed, drilled or turned in a lathe. It is adapted to make castings of every kind.

White and gray iron.

Wrought or *malleable iron*, also called *soft* and *bar iron*, is made by subjecting the cast, or crude iron, which is very impure, to repeated fusions, which burn out the foreign particles, and leave the metal free. It is then taken out of the furnace, and by means of ponderous hammers, or rollers, beaten or pressed together, so as to form one tenacious mass. It is finally drawn out into bars of a convenient size, and in this form constitutes the *malleable* or *wrought iron* of commerce.

Malleable, or wrought iron.

Steel is made by imbedding bars of malleable iron in powdered charcoal and subjecting it to an intense furnace heat for several days in succession, when it is found to be converted into steel by a certain chemical effect of the charcoal upon the iron, which is not perfectly

Steel.

understood; but the carbon of the coal has completely penetrated the iron in order to produce the change. The quality of steel is greatly improved by successive processes of re-heating and re-hammering. *Tilted steel*, *shear steel*, *cast steel*, are names given to the metal wrought in different ways. The latter is the most perfect variety, and is employed for all fine cutlery.

A new mode of manufacturing both malleable iron and steel has lately been invented and gained great popularity. It is called the "*Bessemer process*," from its originator, Henry Bessemer of Sheffield, England, who, several years ago, gave an account of his discovery in a paper read before the British Association at Cheltenham, entitled "The manufacture of malleable iron and steel without fuel." His method seems almost the reverse of the common process by which iron is made to imbibe the carbon of the fuel; the aim being to *decarbonize* or withdraw from the metal the carbon which has so long been considered as essential to its perfection in the condition of steel. But the new process has proved a complete success, although received at first, like all remarkable discoveries, with great prejudice and distrust. Mr. Bessemer erected steel works for himself in Sheffield, where he not only tested and perfected his invention, but contrived an ingenious apparatus for its practical application. Over five hundred thousand tons of steel are now produced annually in England by this process; and this country, having adopted it in many

Bessemer's steel.

places, produces from fifty to seventy-five thousand tons.

Damascus steel is a kind prepared anciently at Damascus, of extraordinary beauty and temper. The method of its manufacture is not fully known, and the attempted imitations as yet are very inferior to the original. It is used for sword, scimiter and cutlass blades and is in great demand by military men. The surface presents a variegated appearance of watering or veining. The finest steel known, called *wootz*, is produced by the natives of India, in a very rude way, and is used in the manufacture of the celebrated sword blades of the East.

Damascus steel.

In working steel, the articles are first finished in a soft state and afterwards hardened and *tempered* by raising them to such a temperature as is necessary to give them the requisite qualities. By heating to redness, and cooling suddenly, steel becomes hard, brittle and elastic. By cooling slowly, it becomes nearly as soft as ordinary iron; so that any degree of hardness between these two extremes is easily obtained. The workman understands by the color of the film over the metal when it is of the proper temper for different purposes. Thus a light straw color indicates the degree of heat requisite for razors; a deep yellow for scissors, knife-blades, etc.; while sword-blades, watch-springs, and various instruments requiring great elasticity must be exposed to a much higher degree of heat, or until their surfaces acquire a deep blue color.

Tempering steel.

The uses of iron are absolutely innumerable, and science is every year applying it to new or more extended purposes. Steam-power on land or water is dependent upon it, as well as thousands of other mechanical operations. It furnishes material for architecture, for steam-vessels, for arms and other munitions of war, for household and agricultural implements, for all kinds of cutting instruments. Most of all it supplies the enormous amount demanded for our constantly extended lines of railroad which are likely soon to span the habitable globe; while submarine telegraph lines supply the missing links in the chain of communication.

Uses innumerable.

Almost all the countries of Europe produce iron; but the mines of Great Britain, Russia, Sweden and Norway, are most worked. The iron of Sweden is considered superior to any other. In this country the localities are very numerous where ore is procured, and the vast resources of the West are only just beginning to be available. Iron Mountain and Pilot Knob, in Missouri, contain incalculable quantities, and of a quality scarcely inferior to the celebrated products of the Swedish mines. Nova Scotia is rich in iron and furnishes it largely to commerce. Pennsylvania yields immense supplies, and in almost every state in the Union it is found in greater or less proportions.

Distribution of iron.

The smelting and working of iron in rolling-mills, machine shops, etc., is carried on by means of mineral coal to a great extent, though charcoal and peat are used in some places.

COPPER.

This well known metal derives its name from that of the island of Cyprus, in the Mediterranean, near the coast of Asia Minor, where the richest mines known to the ancients existed. It is of a red color, brilliant lustre, can be hammered into thin leaves and drawn into wire of great strength. It has a disagreeable smell and taste.

Name and properties.

Copper is very widely dispersed and yields only to iron in point of usefulness. It is found pure, as well as combined with various mineral substances. Its use long preceded that of iron. Mines of copper abound in Europe. England and Wales have some of the most productive and extensive. In Sweden, too, are mines which have been wrought for ages and which still yield immense quantities. That of Fahlun is the most celebrated, and is one of the most astonishing artificial excavations upon the earth. It is of amazing depth, and requires an hour to reach the bottom.

Importance and distribution of copper.

In this country the mines of our Lake Superior region are the most important; and though they have been worked but a few years, already yield metal of such excellent quality, and in such quantity as promises to supply not only our own, but foreign countries, which have hitherto depended mostly upon England. It is found also in numerous other localities, both in North and South America.

American copper.

Copper is frequently found native; usually in small crystals, but sometimes in immense masses, as in the mines of Lake Superior; generally it is in combination with other substances, from which it is separated by heat.

Natural state of copper.

Copper is applied to very many useful purposes. It is formed into thin sheets by being heated in a furnace and subjected to pressure between heavy iron rollers. These sheets are used for the covering of roofs, and domes, the sheathing of the bottoms of vessels, for boilers, stills, and numerous articles of domestic need, ornament, and convenience. It is used to alloy gold and silver for coin, etc.

Uses of copper.

Brass is an alloy of copper and zinc in certain proportions, generally sixty-six parts copper and thirty-four zinc. By changing these proportions, *pinchbeck* or *Dutch gold* and *German silver* are obtained. *Gun metal*, used in the manufacture of brass ordnance, is an alloy of copper and tin, and so also, are *bell* and *speculum metal*, which contain a larger proportion of tin. *Bronze* for statuary, and other ornamental purposes, contains copper, tin, zinc, and lead. The brass of the ancients was an alloy of copper and tin.

Certain valuable substances are also obtained from copper by chemical processes. *Verdigris* is a thin green coating which appears upon copper when moistened with acids. It is prepared on a large scale by the contact of the metal in plates, with vinegar. This and

Chemical preparation of copper.

several other chemical derivatives of copper, are used in the arts as coloring substances.

Blue vitriol.

Blue vitriol, one of the most important salts of copper, is formed by heating metallic copper with sulphuric acid. It appears in large blue crystals. Large quantities are used in calico printing and in various other ways, one of which is as an agent for exciting the galvanic battery.

The salts of copper are all poisonous, and copper vessels are liable, by their rusting, or oxydation, to impart deleterious qualities to liquids or solids which they may contain; so that much caution should be observed in their use, and the surfaces kept perfectly free from any coating of rust.

LEAD.

Description and properties of lead.

Lead is a soft, bluish gray metal, very well known, and very abundant. It is not found pure, but combined with other ores in the mine. Sometimes it is dug out with the pickaxe, and sometimes blasted out with gunpowder. It is separated from impurities by smelting, and is then so soft that it may be cut with a knife. Its malleable and ductile properties are very weak, but it may be rolled out into sheets of various thickness, and applied to a great many very useful purposes, such as the covering of roofs, the lining of sinks, cisterns, drains, etc., and very extensively as tubes to conduct water. Bullets, shot, and a multitude of other articles, are made of lead.

By subjection to great heat, lead is converted into a fine powder, which assumes several colors. These are used in paints, and in glass manufacture. *Litharge* is a beautiful yellow, much employed in the arts. *Red lead* is another form, equally brilliant and useful. *White lead*, so much used as paint for buildings, is prepared in a very curious way, by what is called the Dutch method. A coil of thin sheet lead is placed in an earthen vessel in weak vinegar, and allowed to remain several months, covered with manure, or other decomposing substances. When opened, the lead is found to be entirely converted into a pure white carbonate, which only needs washing and grinding to be ready for use.

Colors derived from lead.

White lead. Dutch method.

Lead is also alloyed with other metals. With tin, it forms *pewter*, *solder*, *block tin*, etc. Mixed with a small quantity of arsenic, which hardens it, it is used very extensively for *shot*, which is manufactured by being melted at the top of high towers constructed for the purpose, and poured into a vessel perforated with numerous small holes. The lead, in running through, is separated into drops, which, falling from the hight of the tower, become round and cool before they reach a reservoir of water, placed for their reception at the base of the tower.

Alloys.

Shot.

Lead contains poisonous principles, and those who work in it are liable to a very dangerous and often fatal disease, called the painters' colic, or lead colic. Sometimes the water

Lead a poison.

conducted by lead pipes contains enough of the metal to produce serious, or even dangerous effects. It is always advisable to allow water thus conveyed, to run for some time before using.

Lead is found in all parts of the world, and has been in use from very ancient times. The principal mines of the United States are in Missouri, Illinois, Wisconsin, and Mississippi. Those in Galena, in Illinois, are considered as rich as any on the globe. Lead is the heaviest of all except the precious metals.

Mines.

TIN.

Tin is a well known metal of a fine white color like silver, and when fresh its brilliancy is almost as great. It is very flexible, and when a bar is bent a peculiar crackling noise is produced called the *tin cry*. Its malleability is such that it can be beaten into leaves, but it is inferior in ductility and tenacity. *Tin-foil* or leaf, may be made of any required thinness.

Tin.

The ores of tin are found only in a few places; the most important mines being those of Cornwall in England, Malacca in the south of Asia, China, Mexico, and a few localities in South America. In the United States it has been discovered in only one place (Jackson, New Hampshire) and in very small quantities.

The mines of Cornwall have been worked from a very remote period, the Phenicians having traded with the Britons for this metal more than eleven hundred years before Christ.

The ore is usually found in veins or *lodes*, which penetrate the hardest rocks. Masses of many pounds weight are sometimes discovered. The miners follow these veins wherever they wind through the rocks, often to a great depth. The ore is broken up in stamping mills, then melted in furnaces and run into large blocks in which form they are ready for market. This is the *block* or *bar tin*, of commerce; the other form is that of *grain tin* which has undergone a refining process.

Treatment of the ore.

The useful applications of this metal are very numerous. *Tin plate*, of which our tin ware is made, consists of thin sheets of iron coated with tin. These sheets are immersed in the melted metal, which combines at once with the iron and produces a brilliant surface on each side. The sheets are cut up into a great variety of articles of household convenience, used for roofing, tubing, etc. When the coating wears off the dark iron is exposed. It then rusts, and soon becomes worthless.

Tin plate.

Britannia metal, employed in the manufacture of teapots, syrup cups, cheap spoons, etc., is a mixture of tin with several other metals. *Pewter* is composed of four parts tin and one of lead. The well known *bronze powders*, used in printing and in ornamental patterns upon paper-hangings, is a chemical preparation of tin with sulphur and other substances. From its brilliant gold color is often called *mosaic gold*. Ordinary brass pins are tinned or whitened by

Other uses of tin.

boiling them with the metal finely pulverized, in water containing cream of tartar.

ZINC.

Zinc is a hard bluish-white metal, very brittle at ordinary temperatures, but when heated between 200° and 300° Fahrenheit, becomes both malleable and ductile, and what is very singular, retains these properties after cooling. The sheet zinc of commerce is made from the ore at this degree of heat. It is not found native, but is often associated with ores of lead; in another form is called calamine, from which the metal is extracted by a kind of distillation instead of smelting, as it flies off into vapor at high temperatures.

Zinc.

Zinc is used for a great variety of economic purposes. It is hammered or rolled into plates, which are not liable to tarnish, except by a thin film upon the surface. It is extensively employed to protect surfaces exposed to heat, about stoves, flues, and furnaces. The zinc of commerce is generally impure. Alloyed with copper it forms brass; and reduced to powder by heat, it is used as an ingredient in paint, as a substitute for white lead.

Uses of zinc.

Galvanized iron is sheet iron coated with zinc. It is used in the galvanic battery, and in various electrical experiments.

White vitriol is a chemical preparation of zinc. It is used in the arts and in medicine.

Zinc is found in various parts of the world, but

our chief supplies come from Germany. In New Jersey, calamine is procured in large quantities and of remarkable purity.

NICKEL.

Nickel is a brilliant silver-white metal, softer than iron, and extremely ductile. It is not abundant, and occurs in Europe and elsewhere, associated with other substances. It is almost always found native in meteoric iron. The chief use of nickel is in the manufacture of German silver; and also that of pottery and porcelain. It is very difficult to separate from the metals with which it is combined. In this country it has lately been coined. It is found in Connecticut, Pennsylvania and Maryland.

Nickel and its uses.

ARSENIC.

This metal is generally found in combination with others—especially with iron, nickel, copper or tin. It is of a dark steel color, so brittle that it may be easily reduced to powder. The greater part of the arsenic of commerce is obtained from Silesia, in Germany, by roasting the substances which contain it in furnaces. The arsenic is volatilized by the heat, and passes off through the flues of the furnace into chambers, where it is condensed and collected in the form of a white powder. This is a very powerful poison. The workmen who open the chambers to remove the powder are obliged to use great precautions against its dele-

Arsenic.

terious effects. They are completely encased in leather, with glazed apertures for the eyes, and damp cloths over the mouth and nostrils to avoid inhaling the deadly particles.

Arsenic is used in medicine and in the arts. It forms beautiful colors, and is applied to the manufacture of glass and porcelain, and in calico printing. It prevents the decay of organic substances to a considerable extent; and when death is produced by this poison, the decomposition of the body is greatly retarded. This circumstance has led to the discovery of the fact of poisoning in many instances, even after a long time had elapsed. It should be used with great caution, as in solution it is nearly colorless and tasteless; which favors its employment for criminal purposes, and often occasions fatal mistakes when used for the destruction of vermin. When heated in the powder, it has a strong and marked odor of garlic, which is considered one of the simplest tests of its presence.

Uses and properties.

ANTIMONY.

This metal has some properties in common with arsenic. It is a very brittle, bluish-white substance, and enters into the composition of some important alloys, such as type metal, Britannia metal, etc. It is used in medicine in many forms. When heated it is converted into white fumes.

Antimony.

Antimony is found in many places in both conti-

nents, generally combined with other substances. Much is brought from the south of Asia in the shape of ore, which furnishes ballast to vessels. Germany, Britain, France, Spain, Mexico, are producers of this metal to some extent, but the greatest quantities come from Singapore, which receives it from Borneo and other eastern islands.

Sources of supply.

MAGNESIUM.

This is a metal of a silver-white color, and is always found in combination with other mineral substances. Associated with lime, it forms a peculiar limestone, called dolomite. With other minerals, it forms soapstone, serpentine, meerschaum clay, etc. Calcined by heating, it forms a valuable powder used in medicine.

MANGANESE.

Manganese is a grayish white metal, resembling some varieties of cast iron. It is very brittle and hard, and a fragment properly fixed may be used to cut glass in place of the diamond. No practical use has yet been made of this metal, but it is believed that it may prove of great value as an alloy for others. Salts of manganese are used in glass-making, and a violet color is obtained from it, employed in painting porcelain, enamel, etc.

Manganese.

CHAPTER IX.

MINERALS.

COAL.

THIS most important and indispensable substance, is known to every one in respect to its appearance, properties and uses. It is the product of accumulated vegetable matter, which flourished mainly during a particular period of the earth's history known in geology as the "Carboniferous Period."

Origin of coal.

Coal occurs in veins or strata enclosed between layers of limestone, slate or iron ore. Its vegetable origin is proved by the fact that in every coal mine are found leaves, trunks and fruits of trees in immense numbers, many of them in the most perfect state of preservation; so that the botany of the coal period can be studied with great accuracy. An additional proof is that a thin layer of coal will exhibit under the microscope, all the pores and vessels of the plant to which it originally belonged. Coal is very extensively distributed on both continents and is mined to a very great extent. Indeed the procuring and transporting of the coal of commerce, forms one of the most extensive branches of business and employs

Proofs of vegetable origin.

the greatest amount of labor of almost any in the world. The mines often penetrate to vast depths into the earth, where the coal is cut out and brought to the surface with great labor and exposure; for there are many dangers and risks which miners are obliged to incur in prosecuting their dreary and darksome work.

Commercial importations of coal.

Sometimes they encounter foul air which suffocates them; sometimes inflammable gases are set free which take fire and produce terrible explosions. Some of these dangers can be guarded against and some can not.

Dangers in mining.

There are several varieties of coal. *Anthracite*, or hard coal, is one of the most valuable. It is very solid and burns without much flame. *Cannel* coal is very compact and of so fine a texture that it may be cut into ornamental or useful articles of small size. It is chiefly found in England and Scotland. *Bituminous coal* is much softer and burns with a flame. *Brown coal* or *lignite* has some traces of its woody structure, and is thought to be of much more recent formation than some of the other varieties.

Varieties of coal.

From bituminous coal is made the common illuminating gas of our cities, by subjecting it to great heat in iron tubes where the constituent elements of the coal are separated; the gaseous portions passing off for illuminating purposes leaving the solid parts behind. This residue is called *coke* and burns with great intensity without flame or smoke. In many places this gas is formed naturally in the earth and escapes from

Coal gas and coke.

the surface of the ground. The town of Fredonia in New York is illuminated by such a natural supply.

Coal tar and its products.

Coal tar is a thick substance formed in the production of illuminating gas from coal. It was formerly thought useless, but within a few years it has been turned to very important uses by distillation, and thus separating its constituents. *Benzole*, an oily liquid used for dissolving resins, camphor, wax, india rubber, etc., is one of these elements, and there are several others equally valuable. *Napthaline*, bears some resemblance to camphor in appearance, and others are used to some extent in the manufacture of candles.

Coal oil or Petroleum.

Oils similar to those obtained by distilling coal are found to issue from the earth in various localities, and often in great abundance. The thinner and purer kinds are called *Naphtha;* the thicker and more impure *Petroleum.* Some of the most remarkable localities are in the region of the Caspian Sea in Persia, and in Burmah. In Italy too, and in the United States they occur in various places. Within a few years great attention has been given to the subject in this country, and by boring in various productive regions, immense quantities of petroleum have been thrown into commerce. *Kerosene* is a form of it in most common use. It has undergone a clarifying process and is often transparent as water. It has superseded in a great degree the use of animal oils for lamps, etc. Oil springs and wells are very abundant in Pennsylvania.

GRAPHITE.

Graphite or *plumbago*, often called *black-lead*, although there is no trace of lead in its composition, has a metallic leaden lustre, and feels greasy to the touch. It is found in many places in England and the United States, never perfectly pure but mixed with a little iron. It can not be fused by the most intense heat. Its principal use is in the manufacture of "lead pencils," as they are called, crucibles, or melting-pots, and as a polish for iron surfaces, etc.

Graphite.

Most of the ordinary pencils are made with a paste composed of powdered plumbago and some other substances fused together and cast in blocks, from which the "leads" for the pencils are sawed, and then enclosed in cylinders of cedar wood. The best are made from pure graphite. There is an extensive establishment for the working of graphite near Lake George in the State of New York. It is also abundant in Pennsylvania.

Pencils.

CHARCOAL.

Charcoal though not a mineral substance may as well be spoken of in this connection. It is prepared by firing wood, piled in mounds or pits, and covered with turf or soil in such a way as to exclude the air. When the wood is thoroughly charred, the admission of air is entirely cut off and the combustion ceases. It is now ready for use. *Soot* and *lamp-black* are carbon in a state

Charcoal.

of minute division. *Lamp-black* is obtained from tar and resinous substances, and is procured by allowing the fumes to pass into chambers where they settle and are collected. *Animal charcoal*, *bone-black* and *ivory-black* are names given to the products of bones, ivory shavings, etc., after heating in close vessels where the air is not admitted.

LIMESTONE.

This important mineral, in some of its varieties, is found in almost every portion of the known world, and serves a great number of useful purposes. It is employed as a building stone in its common forms. *Marble*, which is composed mostly of lime, is used for statuary and other ornamental work, as well as in architecture. It is of various colors, great hardness, and admits of a beautiful polish. The island of Paros, in the Grecian Archipelago, produced some of the most valuable marbles, such as were used by the ancient sculptors of Greece, and considered the finest in the world. It was called *Parian* marble. Many varieties of marble are found in this country. The term marble is applied to those compact varieties, which are capable of being worked in all directions, and also of taking a good polish. Serpentine is a beautiful stone of a mottled green color. When associated with carbonate of lime it constitutes the *verde antique* marble.

Limestone and its varieties.

The *lime* of commerce is produced by heating any of the limestones in a kiln or furnace, the

interior of which is somewhat in the form of a hogshead, and is filled with alternate layers of limestone and fuel. The lime, as it is burned, gradually sinks down and is removed by openings at the base of the furnace, while fresh materials are continually added at the top. This is the *quicklime* or *caustic lime* of commerce. It is used in building, for mortar, and cement, when mixed with sand; for a fertilizer of soils; by the tanner in preparing leather; by the soap-maker for treating his oils, etc.; by the sugar-maker in refining his syrups; and in innumerable other ways in the arts and in medicine.

Lime and its uses.

Carbonate of lime is one of the most abundantly diffused compounds in nature. It makes the different kinds of limestone, chalk, marl, etc; it is also a principal constituent of corals, shells, spars, and to some extent enters into the composition of the bones of animals. Its most beautiful forms are seen in crystals, such as the stalactites and stalagmites in caves, where the water which trickles through the rocks, contains it in solution, and deposits it with every drop till a mass like an icicle hangs from the roof, and another incrustation rises where the drops fall, till they meet at last, forming a pillar. The part hanging from above is called stalactite, and that which rises from the floor, stalagmite. The effect of thousands of these crystalline forms under the glare of torch-light is magnificent. Limestone, or marble, is much used for architectural purposes, though all the varieties are not equally valuable.

Carbonate of lime.

Some have little strength and are liable to crumble from exposure to the weather, or to split into flakes. The stone of which the Washington monument at Washington, and some of the public buildings in that city are constructed, is of a defective quality.

The term limestone is technically applied to such stones as contain at least half their weight of carbonate of lime.

Bleaching powder.

Chloride of lime, or bleaching powder, is made by exposing slaked lime to the action of chlorine gas. This is of most extensive use in bleaching, and for many other purposes in the arts. It is also a powerful deodorizing and disinfecting substance.

GRANITE.

Granite.

Granite is considered the lowest of the geological formations, and the foundation rock of the globe upon which the others rest when in their natural order. It occurs in masses, which are commonly divided by fissures. It is remarkable for its durability as a material for building. Some of the ancient Egyptian monuments built of this stone, have endured for more than three thousand years, and show no appearance of decay.

Granite is very abundantly distributed over the earth, and is found in several varieties, some much more valuable than others. In New England and other portions of the United States it is of excellent quality, and exists in enormous quantities. The most celebrated quarries in Massachusetts are

those of Quincy, which have furnished stone for many fine buildings in various parts of the country. Bunker Hill monument, the Custom-house, and Court-house in Boston, the Merchants' Exchange and Astor House in New York City, the Custom-house in New Orleans, and many other elegant structures of more recent date are examples. It is sometimes quarried in immense masses. The pedestal of the statue of Peter the Great, at St. Petersburg, consists of a single block of granite, from Finland, which weighs 1280 tons. An ancient statue in Egypt, of red granite, has an estimated weight of 887 tons.

Abundance of granite.

Granite is one of the most easily recognized of all the rocks. Its colors are generally red, gray, or white. It forms the principal mass of most of the great mountain ranges of the globe. As a commercial article it is commonly sold in the rough block, by the ton, or, if dressed, by the foot. It is much used for monuments, as well as buildings, on account of its strength and durability, as well as its beauty.

Colors.

SLATE.

Slate is a compact stone that may be split into leaves or plates. Its appearance and color are well known. It is found in many places in this country, especially in New England and New York. The slate quarries in Maine are very valuable. The principal use of this stone is to furnish roofing for buildings. Cut into

Slate and its uses.

proper size, and well applied to a roof, these leaves are almost of perpetual duration. Slate is also used for writing and figuring upon, after the surface is smoothed, and a frame of wood placed upon it. In these forms it is important in commerce.

SOAP-STONE.

Soap-stone, or steatite, as it is also called, is a stone so soft that it may be cut or sawed with little difficulty. Common steatite occurs in masses or small beds. In Springfield, Massachusetts, and Francistown, New Hampshire, are deposits of it.

Soap-stone.

This stone is employed in various ways. On account of its softness, and its property of hardening by heat, it can be shaped into many useful forms. Stoves, the hearths of furnaces and fire-places are made of it, and many small vessels and articles of convenience. The name of *soap-stone* is given from the slippery or greasy feeling imparted to it by the oxyd of magnesium which it contains.

PORPHYRY.

This name, which means *purple*, was originally applied to a rock of reddish color found in Egypt, and much used for ornamental purposes; but at the present day the term is employed to designate any rock, whatever its color, which contains detached crystals embedded in a compact base. Such stones are often exceedingly beautiful, and highly valued in the decorative arts.

MALACHITE.

Malachite is a variety of green carbonate of copper, found in a few localities, principally in Siberia and South Australia. It is softer but heavier than marble, and much more difficult to work as it breaks very easily. It is rarely obtained in large masses. There is a deposit in Siberia which lies embedded at a great depth in connection with copper ore. Malachite is manufactured into various ornamental articles, which are expensive and elegant; such as clocks, vases, doors, mantels, slabs for tables, etc. It is cut by circular saws into veneers from one-twelfth to one-eighth of an inch in thickness, and applied with cement to surfaces of iron, copper and stone, which are afterwards ground and polished. Some doors of malachite were exhibited at the London exposition in 1856, which employed thirty workmen for a year.

Malachite.

CLAY.

Clay has a great many uses in the arts which are familiar to every one. There are varieties of it according to the ingredients which predominate, and which adapt it to specific purposes. Clays which are nearly free from iron and lime are used in the manufacture of fire bricks and crucibles. They are called *fire clays*, because they resist so perfectly the action of heat. Such clays are not very common. *Pipe-clay* is a pure white variety, used in making tobacco-pipes. *Meerschaum*

Clays.

clay is so soft when taken from the place of deposit that it makes a lather or foam mixed with water. It is found in various parts of Europe. The name in its German original means "*sea foam*," and describes this peculiarity of the clay. *Ochres* are clays colored red or yellow by oxyd of iron; they are used extensively as paints. *Fuller's earth* has a strong affinity for oily substances. It owes its name to the fact that it is employed to remove the grease applied to wool in spinning. *Tiling* is made from clay in thin sheets, which are baked like brick.

PUMICE-STONE.

This is a very light, spongy and porous stone, found generally in the vicinity of active or extinct volcanoes, and believed to have been thrown out during eruptions. The pumice-stone of commerce is principally obtained from the island of Lipari, one of the cluster of the same name in the Mediterranean. This island is chiefly formed of pumice-stone, and may be said to be the main source of supply to all Europe and the world. The celebrated volcano of Stromboli is upon one of the islands of this group.

Pumice-stone.

Pumice-stone is used for polishing metals and marble, for smoothing the surface of wood and pasteboard, and for various other purposes.

EMERY.

Emery is a very hard mineral, the powder of which is capable of wearing down all other sub-

stances except the diamond. It is used mostly for rubbing and polishing metals and machinery. Formerly it was regarded as an ore of iron. It is very abundant in the island of Naxos in the Grecian Archipelago. It is also found in the islands of Jersey and Guernsey, in the British Channel and in various other places in Europe, but the chief commercial supply comes from Naxos, although other mines produce a considerable quantity. Recently it has been found in several localities in this country, especially in Minnesota and Massachusetts.

Emery and its uses.

Emery paper and *emery cloth* are prepared by brushing the paper or cloth with a thin glue and dusting the emery powder over it from a seive. *Emery cake* consists of emery mixed with a little beeswax so as to form a lump to be used in polishing and rubbing. Emery stick is wood prepared in a similar way.

Emery paper, cloth and cake.

CHAPTER X.

DRUGS AND MEDICINES.

SECTION I.—SUBSTANCES OF VEGETABLE ORIGIN.

CAMPHOR.

THE camphor gum of commerce is the product of a species of laurel, which grows in the East Indies; chiefly in the islands of Borneo, Ceylon, and Sumatra. It is also obtained from China and Japan. The gum is deposited in crystalline particles in the wood of the tree. To extract it, the wood is cut in small pieces and boiled in water, when it rises to the surface and is taken off. Afterwards it is refined and purified. Another method of extraction is by a process of distillation.

How obtained.

When pure, camphor is very white, has an agreeable odor, and a bitter aromatic taste. It is soluble in alcohol, but not in water. It is inflammable, and burns with a bright light. Sometimes it is used for this purpose in the East. Exposed to the air the gum will entirely evaporate, so that much care must be taken in packing and preparing. It is imported in drums,

Properties of camphor.

chests, and casks. Some species of the laurel family afford this gum of different qualities and values. The best is known as *Malay camphor*, being the product of the Malayan peninsula.

Sometimes camphor is found in concrete masses in the heart of the tree. Where it is known to exist, by making incisions, the tree is cut down and the trunk divided into sections, which are split open and the gum removed by sharp-pointed instruments. This is very pure and valuable. Concrete camphor.

Large quantities of camphor are used in medicine. Administered internally in large doses, it acts as a poison. It is thought to hinder the depredations of moths and other insects in furs and woolens if strewn freely among them; but its virtue soon ceases on account of a rapid evaporation. The camphor tree is an evergreen of considerable size, somewhat resembling the linden, with a trunk straight below, but divided into many branches above, which are covered with a smooth greenish bark, shining leaves of a lighter green beneath; small, white clustered flowers, producing a red berry. The tree is a native of China, Japan, and other parts of Eastern Asia. Two principal commercial varieties are found in the market; the Chinese and the Japan camphor. Camphor-tree.

OPIUM.

This substance is the hardened juice of the white poppy, which is probably a native of Asia, though

now found growing wild in the southern parts of Europe, and even in England. The poppy is an annual plant with a stalk rising to the hight of three or four feet. When at its full growth, an incision is made in the green capsule or seed vessel of the plant from which issues a milky juice. This soon hardens, and is scraped off the plants, and worked into cakes which are covered with the petals of the flower to prevent them from sticking together. In this form they are dried and packed in chests for exportation.

White poppy.

Opium is chiefly prepared in India, Turkey and Persia; although the white poppy is extensively cultivated in France and other parts of Europe for the useful oil obtained from its seeds.

Opium is very extensively used in medicine. It contains some of the most powerfully narcotic principles known. In Turkey, China and the East generally, there is an excessive fondness for it, though in some of these countries its traffic and use are forbidden by the laws. It is smoked, chewed and used in a variety of forms, for its exhilarating and intoxicating effects, the ill consequences of which are far more deplorable than those which result from the intemperate use of alcoholic liquors. The powers of both body and mind are soon completely destroyed.

Use of opium in the East.

The ancients were familiar with the processes for procuring opium from the poppy, and the modern inhabitants of India and Persia pursue very nearly the same methods described by writers eighteen centuries ago. A few days after the flower falls

men and women proceed to the poppy fields and make horizontal slits in the capsule, taking care not to penetrate its cavity where the seeds are stored. A white juice soon appears on the edges of the incisions which grows darker colored on being exposed to the air. The field is left in this state for twenty-four hours after which the hardened juice is scraped off with large, blunt knives. Each poppy head affords opium but once. The mass thus collected has the appearance of an adhesive and granular jelly. It is placed in smaller vessels and beaten, being at the same time moistened with saliva. When of proper consistence it is wrapped in leaves and sent to market.

Collecting opium in India and Persia.

Laudanum and *Paregoric* are liquid preparations of opium in spirits of wine. Laudanum is often used as a poison. *Morphia* or *morphine* is the narcotic principle, chemically obtained from opium in the form of a white powder of a very bitter taste. In small and safe doses it is an invaluable remedy for allaying pain and soothing nervous irritation. The opium of Turkey is considered the best although considerable quantities of good opium have been obtained in England and France. The quality of the drug has even been thought equal if not superior to that obtained from the East.

Laudanum and morphia.

GUM ARABIC, SENEGAL, TRAGACANTH, ETC.

Two of the most useful gums of commerce are *gum Arabic* and *gum Senegal*. These are the prod-

ucts of distinct species of the acacia, growing in Africa, from which country these substances are obtained. The gum exudes from the trunk and branches of the trees, and hardens by exposure to the air, or to the heat of the sun. They are both transparent when pure, but gum Senegal is usually in larger masses and of a darker color. It is much used in calico printing, though the artificial gum called *Dextrine* or *British gum*, manufactured from starch, has, to a considerable extent, superseded its employment in this business.

Gum Arabic and gum Senegal.

Gum Tragacanth comes from a shrub not more than two or three feet high, which grows in Syria, Persia, and some other neighboring regions. From incisions it flows slowly at night and ceases during the day. The hardened drops have the appearance of horny filaments, with no smell, and very little taste. Our chief supplies come from Turkey. This gum is of great use in medicine and the arts. It is more expensive than some of the others.

Gum Tragacanth.

Mastic is produced by a small tree which thrives in the south of Europe. It is used in varnishes.

Copal also exudes from certain trees which grow in the East Indies, Africa, and some localities in this country. It comes in lumps or small flat pieces, without taste or smell, and is a very valuable ingredient in varnish. It is exceedingly hard, and difficult to dissolve.

Copal.

Lac, sometimes called *gum lac*, is a substance produced in Bengal, Assam, Pegu, etc., by an insert

upon the leaves and branches of certain trees, as a protection to its eggs. After being deposited, the egg is covered with a quantity of this *lac* formed into cells with as much art as a honey-comb. Lac yields a fine red color, and is employed largely in making sealing-wax. It also yields a color for silk and cotton, and makes a paint and varnish. It is collected twice a year, by breaking down the encrusted leaves and branches.

Lac, or gum lac.

In this form it is called *stick lac*. *Seed lac* is what remains after the coloring matter has been extracted. *Shellac* is produced by melting the seed lac in bags of cotton cloth, by which it is strained from many of its impurities, and is formed into thin plates or sheets. The insect which produces gum lac thrives best on certain species of the fig-tree. A cheaper method of separating the coloring matter from the resinous part having been adopted within a few years, its commercial importance has greatly increased. The celebrated *Lacquered ware*, manufactured in India, China, etc., is made by applying numerous coatings of lac varnish to the articles with a peculiar skill and care, for which the artizans in this manufacture are famous.

BALSAMS.

Balsams are mixtures of resin and essential oils. The crude pitch which exudes from the pine, is an example of a true balsam, as it can be separated by distillation into volatile oil (turpentine) and a hard resin. The principal commercial balsams are the

Peruvian balsam, from a tree of Central America and Peru; the *Canada balsam*, the product of the silver fir; "*Venice turpentine*," from the larches which grow abundantly upon the Alps and Jura mountains, and was formerly an extensive article of Venetian commerce; *Copaiba balsam*, and *Tolu*, from trees of Venezuela and some of the West India islands. There are a few others of less value.

Principal balsams.

BURGUNDY PITCH.

This resin is the product of the spruce fir, and is obtained from the tree by removing portions of the bark and laying bare the wood upon which the juice accumulates and hardens. It is separated with iron instruments, and afterwards melted and strained. Great quantities are collected in the neighborhood of Neufchatel. It derives its name from the province of Burgundy, in the east of France, whence it comes. It furnishes but a part of the substance sold under the name, by druggists. This pitch is employed chiefly as a plaster.

Burgundy pitch.

EUPHORBIUM.

This is a substance obtained from one or more species of the plant Euphorbia, which somewhat resembles the cactus, having leafless, jointed, angular stems, divided into branches of similar structure, with strong prickles at the angles. When

wounded they yield an acrid, milky juice, which hardens on the surface, and being removed constitutes the Euphorbium of commerce. When powdered, it excites by its dust great irritation, so that those who pulverize it are obliged to guard their nostrils, eyes and mouth. It is not so much used in medicine as formerly, on account of its harsh and acrid properties. The plants which produce it grow in the north and west of Africa, the Canary Islands, Arabia, and the East Indies.

Euphorbium.

GAMBOGE.

Gamboge is a gum of a firm texture, and a beautiful yellow or orange color. It is brought chiefly from the East Indies, and is the concrete juice of a tree growing in Siam and *Cambodia*, whence it derives its English name. Incisions are made, and the juice flows out into vessels placed to receive it, where it hardens; and after being formed into rolls it is ready for market. It is used in medicine, and as a valuable coloring agent.

Gamboge.

MANNA.

Manna is also the hardened juice of several trees of the ash family, growing in the south of Europe. It exudes spontaneously in warm, dry weather, and hardens upon the bark into whitish drops or tears. It is obtained by making incisions in the tree and collecting the juice. It comes in chests, and is of a reddish or brownish

Manna.

color, a sweet taste and peculiar smell. It is a mild medicine, and is principally imported from Sicily and Calabria. There are three commercial varieties of manna: *flake manna*, which is the purest, and is gathered in the hottest and dryest weather of July and August; *common manna*, collected in September and the first part of October; *fat manna*, which exudes when the weather is cool in autumn, and does not readily harden.

MYRRH.

This is a resinous or gummy substance, the produce of a tree of Arabia and Abyssinia. It has a fragrant odor and a bitter aromatic taste. It is translucent and of a reddish-yellow collor. It is only used in medicine—although the ancients regarded it as a very precious perfume, and counted it among their most valuable treasures. It was among the costly offerings made by the "Wise Men of the East" to the infant Christ.

Myrrh.

ASAFŒTIDA.

This is the resinous gum of a large, coarse plant, common in India, Persia, Afghanistan, and neighboring regions. The leaves spring from the root, and are numerous, large and spreading; of a leathery texture, light-green above, and pale beneath. The flower-stalk rises from among them, and bears a head of yellow blossoms, and an oval, flat, reddish-brown fruit, which in India is esteemed a valuable medicine. When the

Asafœtida.

leaves begin to fade, the earth is removed from about the top of the root, and stem and leaves twisted off near their base. After awhile the summit of the root is cut smooth, and the juice begins to exude. It is scraped away and another thin slice of the root taken off to promote the flow of the juice. This process is continued as long as it will yield, and then the plant dies.

Asafœtida is brought to this country either directly from India, or by way of Great Britain, packed in mats, cases or casks. It is of a reddish color, and in irregular masses. The odor and taste are disgusting, although by constant use persons can accustom themselves to endure it, from the agreeable effects it often produces as a medicine. In India, and even in France, it is sometimes used as a condiment, for its strong savor of garlic.

LIQUORICE.

The plant which produces this substance is a native of the south of Europe, but is cultivated to some extent in England, and has been introduced into the warmer parts of the United States. The stem is usually about four or five feet in hight, the leaves pale green, and clammy on the under side. Flowers purple, or violet, resembling those of the pea.

Liquorice plant.

The root is dug and dried, or ground and pressed when fresh, to extract the juice, which is afterwards evaporated by slow boiling till it becomes hard. It is then formed into rolls of considerable

thickness, and covered with leaves. This is the state in which it is imported. The refined liquorice of the shops is prepared by re-dissolving and purifying it, and then casting it into small rolls about the size of a quill. This is done in England and this country. Our chief supplies come from Spain and Sicily.

Refined Liquorice.

GINSENG.

Ginseng is the root of a small plant growing in China, Tartary and several parts of North America. It was formerly considered a very important medicine, and extravagantly valued by the Chinese, who sought for it with great eagerness, and paid for it an exorbitant price. Since its discovery in abundance in this country, and its export hence to China, which is almost its only market, its estimation and price have materially declined. It was fabled by the Chinese to possess astonishing virtues; to cure all diseases, to preserve health, and prolong life. It is said to have been worth its weight in gold at Pekin; and the first shipments from North America to Canton yielded enormous profits. The root is fleshy, sometimes spindle-shaped, about as thick as a finger. It is often divided into two portions, connected at the upper extremity, and bearing a supposed resemblance to the human form, from which circumstance it is said that the Chinese name *ginseng* originated, which means the *resemblance of a man.* It is dried, and then consists of a hard central portion, with a

Ginseng.

wrinkled surface, and a soft, whitish bark. It is little used as a medicine, but some people have a habit of chewing it, having acquired a relish for the taste, which is sweetish, and a little like liquorice.

SENNA.

There are several plants which produce this well known medicine. They are all small shrubs, growing in many places in Asia and Africa, and cultivated in southern Europe and the West Indies.

In Egypt the plant yields two crops of leaves, which are stripped off by the natives, together with the pods, which contain the seeds, and dried in the sun. They are then packed in bales for exportation. Different varieties are brought from different ports. That produced in India is esteemed very highly. Senna was first used as a medicine by the Arabians, their country being favorable to its growth. The principal varieties of this drug known in commerce are the Alexandria, Tripoli, India and Mecca senna. A variety of the India senna, cultivated at Tinnevelly, and other places in Hindostan, is considered the most valuable. Senna.

SARSAPARILLA.

This is the root of several species of the plant Smilax, some of which are abundant in this country; but that most used in medicine is brought from Mexico, Honduras, and some of the warmest parts of South America. The dried Sarsaparilla.

roots are several feet in length, about the thickness of a goose-quill. It is used both as a medicine and as a flavor in effervescing drinks.

SASSAFRAS.

Sassafras.

This bark comes from the root of the sassafras tree, which grows almost everywhere in the United States. It is a tree of middling size, growing much larger in the Southern than the Northern States. The bark of the root is the part mostly used, though the pith is sometimes employed. It is highly fragrant, and the taste warm and pleasant. Besides its medicinal uses it furnishes a very agreeable flavor in confectionery, beer, etc.

RHUBARB.

Rhubarb.

The *rhubarb* root, well known as a medicine, comes from several places in the East. Tartary, Siberia, Turkey, China, produce it in one or other of the varieties known to commerce. In some places it is cultivated, while in others it grows spontaneously. Certain species of the plant are raised both in Europe and in this country for the sake of its large, fleshy, juicy leaf-stalks, which are used while young and tender in cookery.

Preparation of the root.

The root is dug twice a year in Tartary, whence the best qualities are derived. After being cleaned, the outer bark is scraped off and the root cut into pieces of convenient size, and strung on strings to dry. It is then

assorted and the best sent to Russia, whence it is exported.

JALAP.

This drug comes from the root of a twining plant or convolvulus, which grows in Mexico, whence it is chiefly imported. It derives its name from the city of Xalapa, in the neighborhood of which it is very abundant. Its leaves resemble the ivy, and its beautiful red or purple flowers open only at night. The root, which is a pear-shaped tuber, is dried either whole or cut in slices, and packed in bags for market. Jalap.

IPECACUANHA.

This is also the root of a small shrubby plant growing in Brazil and other portions of South America, in moist, thick, shady woods. The roots are four or five inches in length, and about the size of a goose-quill. They are chiefly collected by the Indians, who tie them up in small bunches and dry them in the sun. Brazilian merchants buy of them, and export the drug from Rio Janeiro, Bahia and Pernambuco, in large bags or bales. Ipecacuanha.

CARDAMOMS.

These are seeds of a tuberous plant, of which there are different species, growing in India, Siam, Ceylon and China. The best are brought from the Malabar coast. The plant grows wild among the

mountains, springing up in openings, especially where trees have been burned and ashes scattered. The capsules containing the seeds are picked and dried over a gentle fire, or in the sun, for market. It is also cultivated by the natives of Malabar; great numbers deriving a livlihood from this source. The seeds are of a warm and stimulating nature; and often used as a condiment in the East. They form a universal ingredient in *curry powder*, and other sorts of Oriental food.

Cardamoms.

ORRIS ROOT.

Orris or *Iris root* is obtained from a plant of the iris family which grows in Italy. The thick, fleshy root is dug in the spring, the cuticle and fibres removed and then it is carefully dried. It is brought from Leghorn in casks. In a state of powder it is used in medicine and as a dentifrice on account of its agreeable odor.

Orris root.

PERUVIAN BARK.

Peruvian or *Jesuit's bark* is a very important article of commerce as well as a very valuable medicine. It is derived from several species of a tree called in botany *cinchona*, which grows principally in South America. It was originally obtained from Peru by the Jesuit priests who early ascertained its medicinal value. Such has been the eagerness to procure the bark that fears have formerly been entertained of an

Where obtained.

entire exhaustion of the supply in consequence of a reckless destruction of the trees. Measures were taken accordingly to introduce them into Java and other localities of the East with success.

Some of the cinchona trees are large, others are small, and some mere shrubs. The bark is procured mostly by the natives, who fell the trees and remove it, or take it off while the tree is still standing. It is then dried quickly as possible in the sun, when it rolls up or becomes quilled. It is packed in cases of ox-hide lined with coarse cloth, and shipped from many South America ports. *Quinine*, one of the most important of all medicines, is obtained from this bark by chemical means. Preparation.

STRYCHNIA, ACONITE AND BELLADONNA.

Strychnia, one of the most powerful of vegetable poisons, is obtained from the berries of the Nux vomica, a small tree growing in India. *Aconite* is extracted from the root and leaves of the well known plant "Monk's Hood." *Belladonna* comes from the deadly nightshade, all parts of which are very poisonous. Strychnia, aconite and belladonna.

SECTION II.—SUBSTANCES OF MINERAL OR CHEMICAL DERIVATION.

SALTS.

Many of the drugs and medicines in common use are of a form chemically known as *salts*. For-

merly this term was applied to all substances indifferently, which resembled *common salt* in appearance and properties. Subsequently it was given to any compound produced by the union of an acid and a *base;* that is, an alkaline or other substance capable of combining with it in such a manner as to destroy or neutralize its properties. With the constant advance of chemical knowledge the term *salt* at the present day has a still wider application. But its simplest definition, given above, is sufficient for our purpose in describing a few well-known medicines.

Chemical salts.

EPSOM AND GLAUBER SALTS.

The first of these is a sulphate of magnesia, (that is, a combination of sulphuric acid with the alkaline substance magnesia,) and is made from sea-water which has been partially evaporated. Certain other chemical substances are added, resulting in this familiar medicine. It has a bitter and disagreeable taste. *Glauber salts*, (or sulphate of soda) named for the chemist who first produced it, is also found in sea-water and many mineral springs. The complete evaporation leaves the salt behind in crystals.

Epsom and Glauber salts.

SAL AMMONIAC, HARTSHORN, SMELLING SALTS.

The substance that often goes by all these names is the crude salt, chemically called *muriate of ammonia*, which is made from the liquor found in the

condensing vessels of coal gas works; and also from a liquid which results from the preparation of bone charcoal for the use of sugar refiners. These liquors are evaporated, and the crystals which form are *sal ammoniac* or *muriate of ammonia*. These crystals are used in preparing the liquid and other forms of ammonia. Sal ammoniac.

Hartshorn, or volatile alkali, is a name given to some of these preparations, because formerly shavings of the horns of deer were used in their manufacture. Both the salts and the liquid ammonia are used in many ways. Hartshorn.

Ammonia occurs naturally in the craters of volcanoes. It was formerly imported from Egypt, and from having been originally procured from a district in northern Africa, near the temple of Jupiter Ammon, acquired its name. Many salts of ammonia may be produced by combining it with various acids. Most of the sal ammoniac consumed in the United States is obtained from abroad. Its commercial varieties are known under the names of *crude* and *refined*. The crude is imported from Calcutta in chests containing several hundred pounds. It is used extensively by artisans in brass and copper to keep the metallic surfaces bright preparatory to brazing. The refined quality comes mostly from England, packed in casks. Sources.

BORAX.

Borax is one of the salts of soda. It is white, transparent, and has an alkaline taste. It has been

found in small quantities in Thibet and South America, but the principal supply is obtained in the volcanic districts of Tuscany, in Italy, from basins called lagoons, into which jets of steam and boiling water holding this substance in solution, are continually entering from fissures in the earth. Here these steam jets are made to deposit their acid. The water is afterwards evaporated, leaving the white, scaly crystals of borax. A large part of the borax of commerce is thus obtained. It is a valuable medicine.

Borax.

Those who visit the lagoons of Tuscany where borax is found, describe them as places of great and singular interest. "As you approach them" says Dr. Bowring, "the earth seems to pour out boiling water, as if from volcanoes of various sizes, from a variety of soils, but chiefly of clay and sand. The heat in the immediate neighborhood is intolerable, and you are drenched with vapor of a strong and sulphurous smell. The whole scene is one of terrible violence and confusion; the noisy outbreak of the boiling water; the rugged and blasted surface; the volumes of steam; the impregnated atmosphere. The ground burns and shakes beneath your feet, and the whole surface is covered with crystallizations of sulphur and other minerals."

Lagoons of Tuscany.

In such localities are constructed the basins for the collection of the boracic acid. They are walled up with masonry, openings being left for the admission of the steam escaping from the earth. Water from adjacent springs is conducted into the

basin, which absorbs the acid brought up by the ascending vapor, and at the same time is heated to the boiling point. This water, after having absorbed the greatest possible amount of the acid, is evaporated in leaden pans by the volcanic steam. The annual production from these sources is about three million pounds. Borax is used as a flux in working metals.

ALUM.

Alum is occasionally found as a natural product in the earth, but the greatest proportion of that employed in the arts and in medicine, is manufactured artificially, by a chemical process. The materials, consisting of the sulphates of alumina and potash with a proper proportion of water, are put in large casks and allowed to stand several weeks, when the interior of the cask becomes lined with a thick coating of crystals. Alum. The staves of the cask are then removed, and an enormous mass of alum crystals of the shape of the cask, are left standing; these, when drained and broken up, constitute the alum of commerce. The best is made at Civita Vecchia in Italy. It is much used to fix colors which would not otherwise adhere to the fabric, and also employed in many ways in medicine.

NITRE OR SALTPETRE.

This salt exists in a natural state in many places. The chief sources of supply are certain districts of the East Indies, where it is found in the soil, and

often on the surface of the ground. It is obtained by draining water through the earth, and allowing this, which contains the dissolved salt, to evaporate.

In Europe, nitre is formed artificially by mixing animal refuse of all kinds with old mortar, wood ashes, etc., in heaps, exposed to the air, but sheltered from the rain. These heaps are watered from time to time, with foul and putrid liquors, and after the lapse of two or three years, the mixture is washed and the salt dissolved out.

Artificial preparation.

The earth on the floor of many caverns, becomes impregnated with substances, which, when leached with wood ashes or mingled with potash, yield nitre, (chemically called nitrate of potash.) The mammoth cave of Kentucky affords it in large quantities.

Aqua fortis, (or nitric acid,) one of the most powerful acids known, is derived from this salt by chemical means. It is used in a great variety of ways in the arts and in medicine.

Aqua regia (royal water) is a mixture of nitric acid (or aqua fortis) with another acid (hydrochloric), and is remarkable for its power of dissolving gold and platinum. The ancient alchemists called it *royal water* for that reason.

Aqua regia.

Nitre is one of the most important of substances, and its uses are too many to enumerate. Besides being an essential ingredient in gunpowder, it is an antiseptic, and employed in preserving meat. Its value in medicine and surgery is also very great.

Importance.

SULPHUR.

Sulphur is a substance very widely disseminated throughout the mineral kingdom, and is almost always present in minute quantities in animal and vegetable matter. It occurs in the earth either in a native state or in combination with certain metals, such as iron, lead, mercury, copper and zinc, forming compounds called *sulphurets*. When native it is found in masses, clear or in a powdery form mixed with various earthy impurities. Native sulphur is most abundant in volcanic countries, and hence is sometimes called *volcanic sulphur*. The most productive localities are in Sicily and Italy. The celebrated mine at Solfatara (in what was formerly the Kingdom of Naples), is situated in the crater of an extinct volcano. It has yielded immense quantities of sulphur for many years, but lately seems exhausted, and will not pay for working. A large mine of sulphur has been opened in California, about twenty miles from Santa Barbara and seven from the sea-coast.

Sulphur native and combined.

The sulphur is obtained from the earths which contain it by placing them in earthen pots set in furnaces of brick-work, where they are exposed to such a degree of heat as will separate the sulphur from them, which flows into a vessel containing water. Fire being applied, the sulphur rises in vapor, leaving the impurities behind. This is called *crude sulphur*. To purify it further, it is melted in a cast-iron vessel, and the sediment having subsided, it is dipped out,

How obtained from earths and sulphurets.

and poured into cylindrical, wooden moulds, which give it the form of solid cylinders about an inch in diameter. This is called in commerce *roll sulphur*, or *cane brimstone*. The dregs, remaining after this process, are ground to powder, and constitute a very impure kind of sulphur, called *horse brimstone*. From the native sulphurets (iron and copper pyrites) it is extracted by a kind of distillation.

Crude sulphur comes to this country principally from Messina in Sicily, and the ports of Italy. *Roll sulphur*, and that in the form of an impalpable powder called *sublimed sulphur*, or *flowers of sulphur*, come from Marseilles.

Great quantities of crude sulphur are employed in making sulphuric acid, the most important of all the acids, and a great many other chemical compounds. It is also used in dyeing, refining the precious metals, etc. Great Britain alone consumes annually more than twenty millions of pounds. In medicine its modes of employment are numberless.

CALOMEL, ETC.

Calomel, etc.

This is a preparation of mercury, with other substances, used in medicine, and considered of great value in certain diseases. *Corrosive sublimate* is another preparation with similar components.

Many other mineral matters are employed for various purposes by physicians and surgeons, which are generally prepared for use by chemical processes. Many of them are deadly poisons, and

of course require to be used with the greatest skill and caution. The limits of this book do not admit of naming any more of them.

Certain chemical preparations, however, used as a means of producing insensibility to pain, called *anæsthetics*, have come into very extensive use within a comparatively recent period. They may be briefly mentioned.

ETHER, CHLOROFORM, ETC.

Ether, or *sulphuric ether* as it is also called, is a colorless, transparent, fragrant liquid, very thin, and evaporating with great rapidity. It is obtained by heating equal weights of strong alcohol and oil of vitriol (sulphuric acid) in a retort, to the boiling point. A highly volatile liquid distils over, which is known as *ether*. It is very combustible, both in a state of fluid, and of vapor, and on this account should never be brought near a flame. When the vapor of ether, mixed with atmospheric air, is inhaled, it produces at first a species of intoxication, which is soon succeeded by a kind of stupor, during which the system is nearly or quite insensible to pain.

Sulphuric ether.

Chloroform is made by distilling alcohol with a solution of chloride of lime (bleaching powder). It has an oily appearance, is colorless, and of a pleasant, ethereal odor, and a sweetish taste. What is called *chloric ether*, contains an excess of alcohol, and is the liquid generally sold and used under the name of

Chloroform and chloric ether.

chloroform. The vapor inhaled with atmospheric air produces effects similar to those of ether.

Nitrous oxide is a gas prepared from nitrogen and oxygen, which has a peculiar, exhilarating effect when inhaled. It is sometimes called *laughing*, or *exhilarating gas*. It will also produce an insensibility to pain, of a more transient character than ether or chloroform. Dentists frequently use it to give relief from the suffering, incident to operations upon teeth. Its preparation is more expensive than that of the others, and its use is comparatively restricted.

Chloral, or hydrate of chloral.

Chloral, or *hydrate of chloral*, as it is usually termed, is a preparation of very recent date, designed to produce effects of a similar kind to those mentioned above, although it is taken into the stomach instead of being inhaled. It is a liquid compound of chlorine, carbon, hydrogen and oxygen, chemically obtained.

SECTION III.—MEDICINAL OILS.

Oils of various kinds are used as medicines, the most common of which are *castor-oil*, *croton-oil* and *cod-liver oil*.

Castor-oil is obtained from the seeds of the castor-oil plant (Palma Christi) found native in many tropical countries. The oil is separated from the seeds by boiling them in water, or by pressure. The latter mode is much the best. The castor-oil

plant is extensively cultivated in many portions of this country, especially in New Jersey, Virginia, North Carolina, and Illinois. The oil is manufactured on a large scale in St. Louis. Castor-oil. Hydraulic and other improved presses have within a few years been adopted, with most favorable results, the quantity of oil being much increased, while time and labor are economized.

The seeds are about the size of a small bean, of a grayish or ash color, marbled with reddish-brown spots and veins. They are covered with a prickly capsule, which has three cells, each containing one seed. In hot climates the plant becomes a small shrub or tree, in cold ones it is an annual.

Croton-oil is derived from the seeds of a shrub growing in Hindoostan and other warm portions of Asia. The fruit of this shrub is about the size of a hazel-nut, somewhat tri- Croton-oil. angular in shape, and contains, like the castor-oil plant, three seeds about as large as a pea. These seeds yield the oil by pressure. This medicine has been in use for a long time in India. The oil is often used externally to irritate the skin. It is a very powerful drug.

Cod-liver oil is obtained from the livers of codfish by heating them, and also by pressure. The best oil is without color, taste, or smell, and Cod-liver oil. of a very light color. It is often adulterated with other fish oils, chiefly bleached whale oil. It is considered a valuable remedy in pulmonary complaints.

There are three varieties known in the market;

white or pale yellow, brownish yellow, and dark brown. They differ only in the mode of preparation; the pale being made from fresh, sweet livers, the dark brown from livers in a state of putrefaction; and the brownish yellow from those in an intermediate state. Great quantities are obtained on our coast. Twenty or thirty thousand gallons annually are procured by seamen between Boston and Eastport in Maine, with special reference to the drug market.

SECTION IV.—LEECHES AND SUBSTANCES OF ANIMAL ORIGIN USED IN MEDICINE.

THE *leech* is an aquatic worm with a flattened body tapering towards each end and terminating in circular flattened disks, the hinder one being the larger of the two. It swims with an undulating motion and moves when out of the water by means of these disks or suckers, fastening itself first by one and then by the other and alternately stretching out and contracting its body. The mouth is in the center of the forward disk, and is furnished with three lens-shaped jaws lined at their edges with fine, sharp teeth. They meet in such a manner as to make a triangular incision in the flesh.

The leech.

The leech is from two to four inches in length, and is marked by dark lines along its back, which

vary in color from a blackish to a grayish green. It inhabits marshes and running streams, and is abundant throughout Europe. It can be kept a considerable time in certain kinds of moss or moistened clay, and is frequently transported to great distances by dealers.

Leeches.

The frequent use made of leeches in the practice of medicine has caused them to become a considerable article of commerce. They are collected in Spain, France, Italy and Germany, and carried to London and Paris. They are also exported to this country, although our own waters furnish them in great numbers.

Leech-gathering.

The occupation of the leech-gatherer is a very dreary and uncomfortable one. He goes with naked arms and legs, wading in bogs and streams where these worms are known to abound. Some of them attach themselves to his limbs, from which he transfers them to his pouch. Others are caught by the hand as they swim slowly in the water or hide among the roots and mosses. Others are scooped up in a small vessel. The trader buys the whole lot and afterwards assorts them for the market. They are used for the local abstraction of blood.

CANTHARIDES.

Cantharides or *Spanish flies*, also called blistering flies, are the dried bodies of a kind of beetle which inhabits the south of Europe, especially Spain, Italy, and the south of France. This insect is over

half an inch in length, of a beautiful, shining, golden-green color, with a large heart-shaped head, bearing two thread-like, black, jointed feelers. The wing-sheaths are long and flexible, covering brownish membranous wings. When alive the Spanish flies have a strong, penetrating, fetid odor by which swarms of them may be detected at a considerable distance. At certain times of the year these beetles frequent particular trees, the poplar, elder, ash, etc., to feed upon their foliage, and at these seasons they are collected. The time selected for this purpose is early in the morning, when they are torpid from the cold of the night. Persons with their faces protected by masks, and their hands with gloves, shake the trees or beat them with poles; and the insects are received upon cloths spread underneath for the purpose. They are killed by being plunged into weak vinegar or exposed to its vapor when boiling. After being dried thoroughly, they are put into casks or boxes lined with paper, to exclude the moisture of the air, and sent to foreign countries. Considerable quantities are also brought from St. Petersburg, derived from the southern provinces of Russia, where the insect is also abundant. Russian flies are distinguished by their greater size, and a color approaching that of copper. They are much used in medicine, chiefly for raising blisters.

Cantharides.

CHAPTER XI.

COLORING MATTERS.

COCHINEAL.

THE *cochineal* is an insect which feeds on certain species of cactus growing in Central America and other warm latitudes in this country and the West Indies. It is small, seldom exceeding the size of a grain of barley, and was for a long time believed to be a vegetable grain or seed. These insects are carefully reared in immense numbers, by making them deposit their eggs where they can be protected from injury, and where the young insects can be properly nourished by their natural food, the cactus, on which alone they thrive. When they have attained the proper age and size, they are detached from the plant with a blunt knife, put into bags and dipped into hot water to kill them; after which they are dried in the sun. This constitutes their preparation for market. They have the appearance of small, dry, shrivelled berries or seeds, of a brown, purple, or silver-white color. They are imported in bags, each containing about two hundred pounds. Cochineal is used in dyeing scarlet, crimson, purple, and other rich shades, by being ground and having the color ex-

Cochineal Insect.

tracted. Carmine is one of its most valuable and beautiful products. The business of rearing this insect is carried on most successfully in Mexico, from which the greatest part of the cochineal of commerce is derived. The Indians engage in it, and produce large supplies, gathering the crop three times a year. The female insect only is valuable, as it is much larger than the male, and without wings.

Where produced.

MADDER.

This color is extracted from the root of a plant growing spontaneously in the south of Europe and some parts of Asia. It is extensively cultivated in Holland, from which, as well as other European countries it is imported. It is used in dyeing red, and is a cheap and durable color. The roots vary in size from that of a quill to that of the finger. The madder of Turkey affords a very bright color, when properly prepared, and gives its name to the beautiful *Turkey red*, so highly esteemed.

Madder.

Turkey red.

BRAZIL WOOD.

This wood, which affords a fine red color, grows in Brazil. The tree which produces it is large, crooked and knotty; the leaves are tinged with red, and exhale an agreeable odor. The bark is very thick, and the timber is often used for cabinet work. But its

Brazil wood.

principal employment is in dyeing. The best quality has been brought from the region of Pernambuco; but it is found in many other localities.

LOGWOOD.

The *logwood* tree is a native of Central America, and attains its greatest perfection in Campeachy and the West Indies. The wood is hard, compact and heavy, of a deep red color internally. Used in cabinet work it takes a fine polish, and is very durable. It is imported in logs, that are afterwards chipped or ground to a coarse powder. The color of its dyes is a violet red or purple.

Logwood.

FUSTIC.

Fustic is the wood of a species of mulberry, which abounds in many parts of South America, in the United States and the West India Islands. It is a large and handsome tree, the wood rather brittle and easily splintered if used for timber, but still hard and strong. The wood, ground or rasped, is very extensively used in the dyeing of yellow, and is largely imported for that purpose from Mexico, Brazil, Cuba, etc. *Tumeric*, another yellow dye, comes from the root of an East Indian plant.

Fustic.

ANNOTTO.

Annotto or *Arnatto*, as it is sometimes written, is a species of red or buff dye, formed from the pulp

enveloping the seeds of a plant common in South America, and the East and West Indies. The pods containing the seeds are placed in hot water, to which the pulp yields its color. This is allowed to dry away in the shade in shallow vessels. It is made up into cakes or rolls for market. The best annotto comes almost wholly from Cayenne, in South America. It dyes yellow, and is sometimes used to color butter and cheese.

Annotto.

INDIGO.

This valuable color is obtained from a plant which is cultivated for the purpose in India and other places in the East, as well as in this country, where it has been introduced. In the northern part of South America and other tropical and warm portions of this continent, the plant will flourish, and already produces considerable quantities. But it has been obtained from a very remote period from the East, and the principal supplies still come from there.

Indigo.

The seed is small, resembling gunpowder in appearance. It is sown in drills a foot apart, in a light, rich soil. When the plants have attained their maturity, they are cut down and placed in layers in a large vessel, and covered with water. In this situation fermentation takes place, the liquor becomes of a greenish color, and when evaporated leaves a blue sediment which is made up into cakes, and in this form becomes the indigo of commerce. It is brit-

How produced.

tle, light, and insoluble in water; but sulphuric acid dissolves it without changing its color. It is used in dyeing, in the laundry, and in medicine.

CUDBEAR AND LITMUS.

Various species of lichen afford, when bruised or pounded and mixed with alkaline liquors, a purple coloring matter, which is much esteemed in dyeing. That which is most used at present, is called *cudbear*, which is prepared from a lichen growing on limestone rocks in the north of Europe. Litmus is a similar dyestuff made from another species of moss which is found on marine rocks, and is especially abundant in the Canary and Cape Verd islands.

Cudbear.

Litmus is prepared by coarsely powdering the lichen and fermenting it in close vessels for several weeks, with certain alkaline substances. The coloring matter is thus separated, and afterwards taken out, dried and cut into small squares for use. It is much employed in practical chemistry as a test for acids.

Litmus.

CHEMICAL COLORS.

Certain beautiful and valuable colors of recent commercial importance are now produced by chemical processes from various substances. Most of the greens used in dyeing, are of mineral origin, prepared from copper, chromium and lead. Quicksilver produces the splendid vermilion in the form

of cinnabar, found native in some localities, and also artificially made in great abundance, to supply the commercial demand.

ULTRAMARINE.

For many centuries the beautiful stone called *ultramarine* has been known and valued, both for its rarity and its splendid color, a rich, deep, azure blue, such as no other mineral possessed. This stone was often used in mosaic work, or, if found in masses sufficiently large, made into vases and other ornaments, whose beauty was only equalled by their costliness. It was brought from China, Siberia and Persia. Magnificent slabs of this stone ornament some of the cathedrals of Italy. When pulverized and mixed with wax, resin and linseed oil, and worked in water, it deposited a pure powder, or a blue color, and of extraordinary beauty and permanence. This blue received the name of *ultramarine*, and was worth its *weight in gold!*

Lapis-lazuli.

In 1814 a chemist of France, named Vanquelin, discovered in a furnace used for the manufacture of soda, an unknown blue substance, which, when analyzed, proved to be the same in composition with the lapis-lazuli. The constituents of this precious mineral had met by accident, in the proper proportions, and formed it artificially. From this discovery came, some years later, the process of making this most valuable color, at a price which has since brought it within the reach of dyers and painters all over

Artificial ultramarine.

the world. A green variety is also produced by similar means.

ANILINE DYES.

From the distillation of coal tar, among many other interesting and curious products brought to notice within a few years, is obtained a substance called *aniline*. When pure it is a thin colorless fluid of an oily appearance; but as found in the shops, it is generally more or less colored. It has a peculiar odor, and a pungent, aromatic, burning taste. It was first discovered in 1826, among the results of the distillation of *indigo*, and called aniline from *anil*, a name of the indigo plant. The identical substance is found by distilling coal tar, and called by the same name. The chief commercial value of aniline consists in the coloring matters derived from it. Beautiful reds, purples, yellows, blues, and various other tints are obtained from it, some of which are truly magnificent. Those known as mauve, magenta, solferino, etc., are examples. The discovery has already wrought great changes in the art of dyeing, and promises still farther improvements as science shall make known its wider applications.

Aniline colors.

INKS.

Ink is made of a variety of ingredients, according to the use for which it is designed. Common *black writing ink* is generally made by an infusion of nut-galls mingled with dissolved copperas, and some other less important

Black writing ink.

substances. There are many very valuable and well known recipes for making it.

Blue ink is made by dissolving the substance called Prussian blue in a certain acid, and thickening it with a gum or mucilage.

Sympathetic ink is made from a solution of cobalt in an acid. Characters written with it are invisible until exposed to heat, when the letters appear blue.

India ink or sepia is a solution used much in water colors. It comes chiefly from China in rolls or square cakes, and is made of fine lamp-black and animal glue. Formerly it was supposed to be derived from a gland of the sepia or cuttle fish, which contains a dark-colored liquid, and which the animal is said to use for defence and escape from its enemies, by coloring the water so that it can not be seen. Drawings made of this substance are therefore called drawings in sepia.

India ink.

The name of India ink is applied to it because it was obtained from China through India. It is used by moistening the cake with water and applying it with a brush.

Although the cuttle-fish does not produce this substance, as was formerly believed, the contents of the ink-bag which it contains, are sometimes dried and used for a color, to a very limited extent. This fish, which is common to the seas of Europe, especially the Mediterranean, also furnishes a bone from five to ten inches in length, and from one and a half to three inches wide, somewhat convex on both sides, which is

Cuttle-fish.

of some use in the arts, and in medicine. This bone is often found floating in the Mediterranean. It is sometimes used in tooth-powder. Small pieces are also hung in bird-cages.

INDELIBLE AND OTHER INKS.

The principal ingredient of these inks is *nitrate of silver*, which, when exposed to the action of light blackens rapidly, if in contact with cloth, paper, or any organic substance. The stain it imparts is permanent, if the ink is properly made and applied.

Printing ink is prepared by burning linseed oil in suitable vessels till it becomes thoroughly charred, and acquires a viscid consistency. It is then mixed with a certain proportion of fine lamp-black. Soaps, resin, etc., are added. Printing ink.

Various colored inks and writing fluids obtain a brief popularity from time to time.

CHAPTER XII.

ANIMAL SUBSTANCES OF USE OR ORNAMENT.

IVORY.

IVORY is the name given to the teeth or tusks of the elephant, and of the walrus or sea-horse. Each male elephant come to maturity, has two tusks which are hollow at the root, tapering, and of various sizes according to the age of the animal. The best are large, straight, light colored and without flaws. Those most esteemed come from Africa, being of a closer texture and less liable to turn yellow than those from the East Indies. The medium weight of a tusk is about sixty pounds. Large numbers of this noble animal are annually destroyed both in Africa and India to furnish this article to commerce. The eastern and western coasts of Africa, the Cape of Good Hope, Ceylon and India, are the great marts whence the supplies of ivory are derived. Large quantities are consumed in the manufacture of handles for knives, parts of musical and mathematical instruments, chess-men, billiard balls, fans, toys and innumerable other articles. Dieppe is more celebrated for its ivory manufac-

Ivory.

Sources and uses.

tures than any place in Europe; but the Chinese excel every other people in the working of this beautiful material.

The tusks and teeth of certain extinct animals of the elephant kind are also found in a fossil state, and constitute an article of commerce of considerable importance. The bones of these animals are very abundant in the northern, and even polar regions of Asia. Although at the present day the elephant is found native only in the tropics, yet in some former period of the earth's history it is evident he had a far more extensive range. Very interesting particulars of the discovery of deposits of these remains are given in a work recently published, from which a few paragraphs are extracted.

Fossil ivory.

* "There hardly exists a more remarkable article of commerce than these remains of an extinct animal. In North Siberia, along the Obi, the Yenisei, the Lena, and their tributaries, from latitude 58° to 70°, or along the shores of the Polar sea, the bones of a species of elephant (or mammoth) are discovered embedded in the frozen soil, or become exposed by the annual thawing and crumbling of the river banks. Dozens of tusks are frequently found together. The most astonishing deposit of mammoth bones occurs in the Lächow islands, where, in some localities, they are accumulated in such quantities as to form the chief substance of the soil. Year after year the tusk-hunters work through the short summer at the

Remarkable deposits.

*Hartwig's Polar World.

cliffs without producing any sensible diminution of the supply. The solidly frozen stratum in which the bones lie, thaws to a certain extent annually, allowing the tusks to drop out or to be quarried.

"The Lächow islands were discovered in 1770, by a merchant of that name, who was engaged in collecting fossil ivory about Cape Sviatoi. He saw, one day, a large herd of reindeer coming over the ice from the north. Resolute and courageous, he at once resolved to follow their tracks, in the belief that they would conduct him to land not yet known. After a sledge journey of nearly fifty miles over the ice, he came to an island, and some twelve miles farther to another, where, owing to the roughness of the ice, and the difficulty of advancing, his excursion terminated. He saw enough, however, of the richness of the two islands in mammoth teeth, to show him that another visit would be a valuable speculation; and on making his report to the Russian government, he obtained an exclusive privilege of digging for mammoth bones on the islands which he had discovered, and to which his name had been given. In the summer of 1773 he returned, and ascertained the existence of a third island, much larger than the others, mountainous, and having its coasts covered with drift-wood. He then went back to the first island, wintered there, and returned in the spring with a valuable cargo of mammoth tusks. From these islands immense supplies have since been derived, and the source seems inexhaustible.

Discovery of the Lächow islands.

"The ice in which these remains are embedded sometimes preserves the entire body of the animal, notwithstanding the ages that must have elapsed since it inhabited this frozen region. In 1799 the carcass of a mammoth protruded from the cliff, and eventually thawed and fell down upon the ice. It was so fresh that dogs and white bears fed upon the flesh for two summers. The skeleton is preserved at St. Petersburg, and specimens of the woolly hair with which it was covered, were sent to the principal museums of Europe." This woolly coat upon the skin is thought to prove that the climate of Siberia, though then, no doubt, much milder than at present, still required the protection of such a covering upon the enormous beasts that once were so numerous there.

Mammoth carcass.

The substance known as *Vegetable ivory* is the kernel of the *ivory nut* the fruit of a species of palm, which grows exclusively in South America. It is about the size of a hen's egg, and when green contains a fluid which gradually hardens into a whitish, close-grained, solid substance, resembling the purest ivory in texture and color. It is cut into small ornamental or useful articles. The ivory tree grows in damp localities, along the banks of rivers and streams. The nuts are chiefly imported from the Magdalena river into Europe and the United States. They are known in commerce as Corosso nuts.

Vegetable ivory.

TORTOISE-SHELL.

This is the shell of a species of tortoise or turtle which is an inhabitant of tropical seas; the finest being obtained on the shores of the Spice islands, and New Guinea. The back of this turtle, which is called the hawk's-bill turtle, is covered with plates or scales spotted or mottled with brown and yellow, which overlap each other like tiles, or slates upon a roof. These are separated by heat, and afterwards softened by the same means, preparatory to working.

Tortoise-shell.

Tortoise-shell is used for inlaying combs, snuff-boxes, and a great variety of ornamental work. These turtles yield, on an average, about ten or twelve pounds. They are much smaller than the green turtle used for food. The goodness of tortoise-shell depends on the size and thickness of the plates, and the clearness and brilliancy of the colors. Singapore is the chief mart for this article.

Uses.

The West Indies likewise produce an inferior quality of tortoise-shell.

WHALEBONE.

Whalebone is a fine elastic substance resembling bone taken from the upper jaw of the Greenland, or right whale. It occurs in long, thin plates, arranged transversely, and fringed at the edges with hairy or thread-like appendages. There are about three hundred of these plates in the mouth of a full grown whale,

Whalebone and its uses.

varying from ten to fifteen feet in length. Their use is to retain the small marine animals which constitute the food of the whale. It is prepared for use by being softened and dyed black.

Whalebone is used in various ways, to stiffen corsets, dresses, etc., in the manufacture of umbrellas, parasols, sun-shades, whips, and for many other purposes. It is one of the important commercial products of the whale fishery.

HORN.

Horn is a hard substance growing on the heads of many cloven-footed quadrupeds, and is an article of considerable value in the arts and in manufactures. The horns of bullocks, being softened by heat, slit open and flattened by pressure, serve to make lanterns, buttons, combs, handles for knives, etc. Horn is often colored to resemble tortoise-shell. When in thin layers it is semi-transparent, and has sometimes been used for windows instead of glass. Combs are made of horn by the following process: The solid tip of the horn is sawed off and may be used for a knife handle or some small article. The stump of the horn which is hollow, is then heated till it is as soft as leather. When in this state it is cut open and pressed between two iron plates. It is then plunged into water, from which it is taken out hard and flat. The comb-maker next divides it into proper lengths, and cuts the teeth with saws and files. The process is much

Horn.

Making a comb of horn.

the same as in working tortoise shell and ivory into combs, except that the ivory must first be sawed into thin leaves.

Besides the supply of horn from a domestic source, immense quantities are obtained from South America, Europe and Africa. The horns of the bison and buffalo, chamois and antelope, are used for the nicer kinds of work. Those of the deer, which are solid and shed annually, are employed for many useful purposes.

Supply.

HAIR.

Hair of various kinds is an article of considerable importance in commerce. The most valuable is *human hair*, especially of late, when it is so generally worn by ladies as an adjunct or ornament to their own. It is derived from various sources, some of which would not add to its esteem in the mind of the wearer. But large quantities are obtained from European countries, particularly Northern France, Belgium and Germany. Hair of the growth of colder countries is more valuable than that of warm ones. The lighter colors, which are most prized, are chiefly the production of Germany; the darker shades are imported from France, where a peasant girl will sell the hair from her head without any sense of degradation. Indeed, so common is the practice in France, that agents are employed to traverse certain districts annually for the purpose of collecting the crops of human hair which are

Human hair.

assiduously cultivated for the money they will bring. Many of these locks weigh more than a pound. In the hands of the barber or perruquier, they are formed into switches, frizettes, curls, and many other styles for ladies' wear; and into wigs, etc., for gentlemen. Certain vegetable fibres which have a resemblance to hair, are largely used in place of it for ladies' head-dresses when fashion requires. *Jute* is the most common. It is from a plant growing abundantly in the East, where the fibres, which are much like hemp, are employed in making gunny-cloth mats, cordage, etc. When laid in long smooth locks and dyed black, or various shades of brown, it furnishes an appendage to the head, which costs little, and at a distance might be taken for human hair. It is also braided and arranged in various forms for sale.

Preparation and use.

Jute.

Horse hair comes next in value. The shorter portions are curled by heat, and used much in upholstery, for stuffing various articles of furniture. That employed in weaving the hair-cloth for covering furniture, comes from the tail of the animal. Large supplies are procured from South America and from Russia. All the dark shades and the gray, are dyed for the manufacture of black hair-cloth. The white is reserved for brighter colors and fancy work.

Horse hair.

The weaving is done entirely by hand, with a kind of hook-shuttle, which is put through the threads of the warp towards the left hand of the weaver. An assistant places

Hair-cloth.

a single hair over the end of the hook which is drawn through the warp. By this tedious process hair-cloth is manufactured.

The hairs or bristles of swine are used to make brushes, etc. That of the cow and ox, for strengthening lime mortar for plaster.

CHAPTER XIII.

GEMS OR PRECIOUS STONES, AND JEWELRY.

THE name of *gem* (from the Latin *gemma* a bud,) is given to certain stones prized from very ancient times for their brilliant lustre, splendid colors, or perfect transparency. They possess, also, a hardness which renders them susceptible of the highest polish and capable of retaining unimpaired the forms into which they are cut, and the lines or figures which may be engraved upon them. These properties, taken in connection with their rareness, have given to them the highest value of all substances. The richest specimens have been prized above all earthly possessions; they have been consecrated by idolatrous nations to their gods; and among the civilized, purchased and held at prices which only the wealthiest governments could pay. Those commonly called "*crown jewels*" comprise diamonds, rubies and emeralds.

Gems.

These stones are usually found in the form of worn pebbles among the sands, derived from rocks in which, doubtless they were originally embedded. Some, however, appear as crystals attached to certain rocky substances; or in the interior of *geodes*, (stony lumps containing crystals inside,) of whose

General appearance of gems before cutting.

dark cavities, they made with other crystals, a glittering incrustation. But in general, these precious pebbles must be submitted to the skill and tools of the lapidary to develop their form and highest lustre.

The great value attached to precious stones led to successful attempts to imitate them at a very early date. The Egyptians possessed the art of coloring glass, and among these objects they produced excellent imitations of the most beautiful gems, so that, as Pliny states, it was difficult to distinguish the false from the real. Artificial emeralds, sapphires, etc., are also spoken of by ancient authors. But in modern times the art has attained a perfection which is truly astonishing, chiefly through the experiments and ingenuity of certain German and French chemists and jewel-workers. A transparent glass of great lustre was invented by a German named Strass, (and called by his name) which is the basis of all the artificial gems. The pure Strass (or *paste* as it is also called) may be cut into the forms of the diamond and readily pass for it. Emerald, topaz, ruby, amethyst, garnet, carbuncle, and indeed every other stone of value may be so closely imitated as to be distinguished from the genuine only by the sharpest scrutiny of those experienced in such matters.

Artificial gems.

The greatest establishments for the production of false gems are in Paris, where an immense number of workmen are employed in furnishing them to commerce. The greatest difficulty is found in imitating the hardness of true gems as well as their permanence of color.

THE DIAMOND.

The *Diamond* is the most beautiful and valuable of precious stones, and has been known and prized as a gem from the remotest ages, no other approaching it in value, except the ruby. Its substance is pure crystallized *carbon*. It is the hardest body known, being used to cut and polish other gems as well as itself. The diamond.

Diamonds are found in various parts of India, chiefly at Golconda, although the supply from this source is greatly diminished. These mines were discovered in 1584, and yielded gems to an enormous value for centuries. At present diamonds are found abundantly in Brazil, Siberia, Southern Africa, etc., from which places the market is chiefly supplied. New localities, however, are discovered from time to time which afford these precious gems to a greater or less extent. Those in South Africa may be mentioned as among the latest. They are obtained by digging in mines, or by washing the sands where they are known to lie, or by searching the beds of streams. They are rarely embedded in rocks, like many valuable metals, but are generally found associated with loose sand and gravel, brought by water from a distance. Sources of supply.

In their natural state diamonds have usually the appearance of semi-transparent rounded pebbles, and are covered by a thin opaque crust. On removing this crust, their wonderful brilliancy becomes apparent. They are Natural appearance of the diamond.

commonly colorless, but are sometimes of a pale blue, yellow, green, or rose tint.

Being the hardest substance in nature, the diamond can only be cut and polished by itself. Sometimes the rough diamonds are made to cut one another, but oftener they are wrought upon a horizontal disk of steel covered with diamond dust and oil, which revolves two or three thousand times per minute; the inferior or imperfect stones being broken up to furnish the powder. The gems are pressed against this revolving plate or disk, and thus ground to the form desired.

Mode of cutting.

Diamonds are generally wrought into the shapes known as the *brilliant*, and the *rose* diamond. The brilliant has a flat summit in the centre, and is surrounded by facets below it, terminating in a blunt point beneath. The rose is flat on the under side, and covered with triangular facets on the upper, terminating in a point above. The brilliant shows the gem to the best advantage.

Forms of the diamond.

The weight of diamonds is estimated in *carats;* 150 carats being equal to one ounce Troy. The brilliancy is expressed by the term *water*, the purest being of the first water, the next of the second, and so on. The rule for calculating the value of diamonds is peculiar, and may be expressed as being in the squares of their respective weights. Thus, if three diamonds of equal quality, weighed respectively, one, two, and three carats, their separate value

Weight, brilliancy and value of the gem.

would be as one, four, and nine—the squares of their weights. This rule, however, only applies to gems of medium size.

Some diamonds of large size and immense value have been found, both in the mines of Golconda and Brazil. The very largest are the product of the former, while Brazil furnishes the greatest quantity. The annual produce of the Brazilian mines, at the present time, is estimated from ten to thirteen pounds, but many are unfit for jewelry. The largest known diamond is an uncut gem, belonging to the crown jewels of Portugal. It was found in Brazil, about the year 1808, and weighs 1680 carats, or about eleven ounces. About the middle of the sixteenth century a diamond was found in Golconda which had the form of half a hen's-egg, and weighed nearly six ounces. This diamond, which was long known as the *Great Mogul*, from its possessor, has disappeared, and is thought to be broken up; the separate pieces now constituting three of the largest gems in the world; one belonging to the sovereign of Russia, and fixed in the sceptre of that empire; the second being the celebrated *Koh-i-noor*, or "mountain of light," taken by the British troops at the capture of Lahore, in India, and now in the possession of the Queen of England; the third belonging to the Shah of Persia. The value of the Russian diamond has been estimated at twenty millions of dollars, and that of the Koh-i-noor at from three to ten millions.

Large or remarkable diamonds.

The other large diamonds most worthy of note,

are a splendid yellow gem belonging to the crown of Austria, which is said to have been once sold as a bit of colored glass; the *Pitt*, or *Regent* diamond, belonging to France, which is of a light blue color, and allowed to be, on the whole, the finest in existence. It was brought from India by Mr. Pitt, and sold to the Regent of France in 1717, for about $700,000, although its value as estimated by a commission of Parisian jewelers, is about $3,000,000.

Other celebrated diamonds.

As the diamond is known to be pure carbon, many attempts have been made to fuse or crystallize some form of carbon less pure, in order to manufacture from it artificially, this precious gem; but they have hitherto failed. A chemist of Paris, in 1853, indeed, succeeded, after a long continued trial with the voltaic battery, in depositing at one of the poles a quantity of carbon in the form of minute microscopic grains, which appeared to be crystals, and were capable of cutting and polishing diamonds and rubies. It is possible that these grains were of the nature of diamonds, but farther experiments must confirm the truth of this.

Manufacturing diamonds.

The origin of the diamond has been a subject of much curious speculation, although the circumstances under which it is found furnish no clue to the process of its formation. Its structure, however, indicates that it is a product in some way of the vegetable kingdom. Sir David Brewster, who has given much attention to the subject, is inclined to the opinion

Origin of the diamond.

that the diamond is a drop or mass of fossilized gum, analogous in some respects to amber. The ancients called the diamond *Adamant*, which word is still in figurative use to express any thing exceedingly hard.

Adamant.

The business of cutting and preparing diamonds and other gems is very extensively carried on by the Dutch Jews at Amsterdam in Holland. There are many imitations of this beautiful gem which are sometimes almost as brilliant as the genuine. Crystals of quartz like the "California diamonds" are very beautiful when handsomely set.

Imitations.

RUBY, SAPPHIRE, TOPAZ, AMETHYST.

These gems are sometimes all included in the scientific term *Corundum*, the hardest known substance except the diamond. They have little natural difference except in color, although they are very unlike as to their beauty and value, the *ruby* being esteemed almost, or quite as highly as the diamond. Its color when perfect is a deep and splendid red, but it is generally pale or of a purplish hue. The Oriental ruby is also called *red sapphire*. The finest rubies are found in India, particularly in Ava. Siam, Pegu, and Ceylon, furnish those less valuable.

Ruby.

The *Sapphire* is a precious stone, usually of a blue color and the hardest of all except the ruby and diamond. The red variety is the ruby. Others are gray, white, green and yellow.

Sapphire.

This gem is found in the same Oriental countries as the ruby, and also in various parts of Europe, Bohemia, Saxony, France, etc.

Topaz.

The *Topaz* varies in color from a deep rich orange yellow, to pale straw color, or greenish white, although the yellow is much the most valuable. Other colors can be imparted to the yellow topaz by artificial means, such as exposure to heat, etc.

Amethyst.

The *Amethyst* is a gem of the most perfect violet color, and of extraordinary brilliancy and beauty. It differs from the ruby and sapphire in color only. It is found in India, Persia, Siam, and other eastern countries. What is called *Occidental amethyst* is merely colored crystal or quartz. It is found in the West Indies and Brazil, while the genuine or oriental, comes from the East Indies. These and many other precious stones, in their natural state, look much like common pebbles, and might readily deceive the uninitiated.

THE EMERALD.

Emerald.

The *Emerald* is one of the most beautiful of gems. It is of a rich, deep green brilliant, and yet grateful to the eye. Large and perfect emeralds are very rare; so that "an emerald without a flaw" has passed into a proverb. They were formerly obtained from the East Indies, but for the last two centuries or more they have been derived from Peru.

JASPER.

This stone enters largely into the formation of certain mountains, especially in India and China. It is of different colors which are often mingled together and give it a variegated appearance. It is used for beads, seals, etc. Jasper.

AGATE.

This is a semi-transparent gem so called because originally found on the banks of the river Achates in Italy. It takes a very high polish and its opaque parts usually present the appearance of dots, eyes, veins, zones or bands. Its colors are very various. It is found in irregular rounded nodules, from the size of a pin's head to more than a foot in diameter. Many very beautiful specimens are found in Great Britain of which the finest are derived from the mountain of Cairngorm in Scotland; whence these stones are sometimes called *cairngorms*. They are found also in other parts of Europe, and in India. *Carnelian* is a common name for agate. It is used for seals, beads, crosses, and other ornaments. The largest agates come from Germany but the finest from India. Agate.

American agates are also very pretty when well wrought, though not of great value.

BERYL.

This stone is also called *aqua marine* from its re-

semblance to green sea water, and is a variety of the emerald. The difference is that while the emerald is always green, the name of beryl is often applied to other colors. This stone is found in India, in several localities of Europe, and in Peru, Brazil, etc., in South America.

Beryl or aqua marine.

CARBUNCLE.

This is a beautiful gem of a deep red color, with a mixture of scarlet, found in the East Indies. It is generally in a pure state, of an angular form and adhering to heavy stone containing iron. Its usual size is from one-half to two-thirds of an inch in diameter. When held up to the sun it loses its deep tinge and becomes exactly of the color of a burning coal. The garnet is said to be the same as the carbuncle of the ancients.

Carbuncle.

OPAL.

The *Opal* is a precious stone found in different parts of Europe especially in Hungary and in the East Indies. When first dug from the earth it is soft, but hardens and diminishes in size by exposure to the air. Opals sometimes contain drops of water. Some specimens emit various colored rays with peculiar brilliance. This stone was much esteemed by the ancients.

Opal.

CARNELIAN OR SARD.

This stone is a variety of chalcedony, found in the East, of a brownish-yellow color, but when

held between the eye and the light appears of a blood-red hue.

Sardonyx is a stone of kindred quality, though of a different shade. It is very hard, but can be engraved and wrought with great beauty.

Chalcedony is the name given to a class of stones according to their color and markings. It embraces the onyx, sardonyx, sard, chrysoprase, and several others.

CAMEO.

The *Cameo* is a precious stone of two or more colors, which are cut in relief. The onyx and agate have been much used for this purpose, having layers of different hues. In the true cameo, this is always the case, and the art consists in so cutting the stone that the different colors are appropriated to the lights and shades of the picture. The term cameo is frequently applied to any kind of gem on which figures are sculptured in relief. Shells are also used for cheaper work of the same kind, the subject being wrought on the outer or white layer of the shell, the pink or brown one beneath, serving for the ground.

Cameos.

JET.

Jet is a bituminous substance found in coal deposits, and often called pitch coal. It occurs in masses, or plates, is of an intense black color, brittle and shining. It takes a fine polish, and is wrought into a variety of orna-

Jet.

mental articles. It is sometimes called black amber. Jet is obtained from Spain, Great Britain, Prussia, and some localities in the United States.

MOSAICS.

There are several kinds of *mosaic*, some suitable for one species of ornamentation, and some for another. But all of them consist in embedding fragments of different colored substances, usually stones, or glass imitations, in a cement so as to produce the effect of a picture. Many articles of jewelry are made in this way which are very costly and beautiful, when richly set. Some of the finest are made in Italy. In the chapel of St. Lawrence, in Florence, are many exquisite ornaments in mosaic which are greatly admired. Mosaic gold, or *Ormolu*, is a peculiar alloy of copper and zinc.

Mosaic.

CORAL.

Coral is a marine production, the work of a minute insect, or polyp, which has the same relation to the coral that a snail bears to its shell, the substance being a secretion from the animal to form its habitation. The ancients were well acquainted with the article, but did not know its origin. There are several varieties, of which the most common and least valuable is the white coral. The red and black are much used in making ornaments.

Coral.

Coral is found in great abundance in many tropical seas. The Red Sea, Persian Gulf, Mediterranean, and many of the waters on the south and east of Asia, produce it. The structure is fixed upon rocks, at various depths, from which it rises in a shrub-like form, often with many branches. When it reaches the surface the animal ceases to work. Although it is so minute, yet in process of time its labors effect great changes in many seas. Some of the most formidable reefs are of coral, and numerous islands are not only formed of the same substance, but constantly forming.

Coral structures.

The manner of procuring coral for purposes of art or commerce is curious and interesting. In the Mediterranean and some other seas, the coral fishers go out in boats, seven or eight in each, and throw out a large cross of wood, to which is attached hoops, hempen cords and loose netting. The whole is sunk with leads, and becomes entangled among the branches and masses of coral. The boats then pull away, and drag the cross, breaking off the substance to which it has attached itself. If it gives way suddenly, or if the rope breaks, the fishers are liable to have their boat upset, and be thrown into the sea, at the hazard of their lives. Sometimes it requires the united strength of several boats to detach the mass which has been entangled by the net and its apparatus. The profits of the venture are divided among the men composing the crews of the boats, the owner having a certain fixed proportion.

Coral fishery.

PEARLS.

Pearls are hard, white, shining concretions usually of a globular form, found in several species of shell fish, particularly the true pearl oyster. Much difference of opinion has existed among naturalists in respect to the production of pearls within the shell of the oyster, but it is now generally believed to be the result of disease or injury; as the shells that are crooked or distorted are more likely to contain pearls than the perfect ones. It is supposed that the effort of the animal to coat foreign particles which may be introduced into its shell by disease or other means results in the globule we call the pearl. As an evidence of the truth of this, it is said that the Chinese throw into a species of shell fish when it opens, small beads of mother-of-pearl, strung upon a thread. In the course of a year they are taken out coated with a pearly crust, which exactly resembles the real pearls.

Pearls and their origin.

The most valuable fishing grounds are on the coasts of Ceylon and Japan and in the Persian Gulf; though they are found in the Gulf of Mexico and on the coast of Brazil, and in many other places, of superior quality. The pearl fishing in Ceylon where the finest specimens are obtained, commences in February and is continued through the month of March. The banks where the oysters abound, lie a number of miles out at sea, and when the weather is stormy the divers can not pursue their toilsome occupation.

Pearl fisheries.

These banks are the property of the government, which puts up to sale the right to fish upon a certain portion during the season. This right is often purchased by the native merchants who send out a force of experienced men to gather what they can of the harvest of pearls.

The fishers set off in boats at day-break, carrying, besides the crew, a number of pearl divers. Arrived upon the ground, one-half the divers prepare to plunge, having their ears and nostrils stopped, and a weight attached to one foot to hasten the descent while a net is fastened to the neck or waist. Holding his breath and seizing the rope with one hand he adjusts the net and dives. Having descended sometimes thirty yards, he gathers into his net as many oysters as possible in from one to two minutes, when he jerks the rope, is drawn up, and assisted into the boat faint and exhausted, (frequently bleeding at the nose and mouth,) to rest while the other half of the divers take their turn. Thus they alternate in favorable weather through the day; sometimes diving a dozen or fifteen times, and bringing up, if skilful and experienced, about a hundred oysters at each trial. It is a laborious and dangerous occupation, and the men who follow it are generally short-lived.

Pearl divers.

When the oysters are brought to shore they are piled in heaps to putrefy, as it would require great force to open them while alive. When they are ready, the shells are easily opened, and the pearls removed.

The inside of the shell of the pearl oyster, and some others, is lined with a substance much like pearl, which is used for inlaying and many other ornamental purposes. This is called *mother-of-pearl*, and the shells which produce it are brought in large quantities from the Red sea and many other places. At Jerusalem there is a considerable manufacture of small articles from these pearl shells, which find a ready market and bring a high price. In Paris and other European cities, pearl work is extensively done.

Mother-of-pearl.

The brilliant hues of mother-of-pearl depend on its structure, which is of fine furrows or wrinkles. These furrows act on the light reflected from them in such a manner as to produce this effect. This may be proved by the fact that if an impression be taken of these surfaces in fine wax, it presents the same iridescent appearance.

Mother-of-pearl is difficult to work, but is cut by the careful use of saws, files, etc.

Not only are genuine pearls in constant request, but an important business is done in the manufacture and sale of *artificial pearls*. And the imitation is so perfect that it has produced a very sensible decline in the demand as well as price of real pearls. Artificial pearls are small globules of thin glass perforated with two opposite holes, through which they may be strung for necklaces, etc. They must not only be white and brilliant, but exhibit the rainbow reflections of mother-of-pearl. This is done by intro-

Artificial pearls.

ducing into the inside of the globule a liquid substance prepared from the scales of certain small fish, which coats the inside surface completely, and gives it a pearly lustre almost as perfect as the genuine. There are several methods of applying this liquid, called *oriental essence.*

The manufacture of pearls is chiefly carried on in France, as the French excel in all branches of imitative art.

AMBER.

Much interest has attached to this substance from remote antiquity, partly from the obscurity of its origin, and partly from a belief in certain wonderful properties it was supposed to possess. It is a brittle, resinous substance, found as a fossil in some soils, and also on certain sea-shores, in small, irregular masses, generally translucent, but sometimes quite clear. The color is a light or deep yellow, and occasionally of a reddish, or dark brown.

Amber.

The source of amber was for a long time doubtful. By some it was supposed to be a mineral; but it is now universally believed to be a *fossil resin*, the product of an extinct species of pine. Wherever found in its natural location, it is associated with carbonized wood or coal.

Origin of amber.

The chief supplies of amber come from the shores of the Baltic sea, where it is apparently washed up by the waves. The largest mass known is in the royal museum at Berlin, in Prussia, and

weighs thirteen pounds. Amber is susceptible of a fine polish, and is often made into ornaments, such as beads, crosses, necklaces, mouth-pieces of pipes, etc. The transparent specimens sometimes contain insects so perfectly and delicately preserved that they could only have become incorporated in it when in a semi-fluid state.

Supplies and uses of amber.

Amber becomes electric by friction; and it was from the Greek word *elektron*, which means amber, that the important science of electricity derived its name. Six hundred years before the Christian era, Thales of Miletus, one of the "Seven wise men of Greece," knew that after yellow amber had been rubbed briskly with wool, it would attract light bodies, straws, etc. This was considered its power of *suction*, and served to invest the substance with a superstitious interest. Many centuries later, Pliny, the celebrated naturalist, mentions the same fact about *elektron*, or amber. But it is now well known that amber possesses the property of becoming negatively electric only in common with other resinous substances.

Electrical properties of amber.

FILIGREE.

This is a kind of ornamental work of gold and silver wire or threads. It is of Eastern origin and manufacture, and was formerly much admired. The most beautiful specimens are made in Sumatra, where the art is understood in the greatest degree of perfection. Bracelets, ear-rings, brooches, chains,

groups of flowers, small caskets, and boxes, are made of it in the most elegant manner, although the tools used by the native artists are exceedingly coarse and clumsy. The Chinese also make filigree, mostly of silver, but it lacks the extraordinary delicacy of the Malay work. It was introduced into Europe by the Italians.

Filigree work.

CHAPTER XIV.

PAPER AND BOOKS.

PAPER.

THE word *paper* comes from *papyrus*, the name of a reed or rush found along the banks of the Nile, or rather in the pools and ditches which communicate with the river. The ancients applied this useful plant to an immense variety of purposes, among others to produce a flat, smooth surface to write upon. The inner bark was divided with a sharp instrument into very thin layers, which were placed side by side longitudinally and glued together at the ends, another layer being glued crosswise above the first, to give the page strength and substance. This was called *Charta Egyptiaca*, (paper of Egypt,) from the place of its manufacture, and became a most important article of trade as well as use, among many nations of the East.

Papyrus.

Linen cloth was also extensively used to write upon. Rolls of it, as well as of papyrus, have been found upon the Egyptian mummies in a good state of preservation, with the inscriptions still legible. It is also

Ancient arts of paper-making.

known that the Chinese fabricated a kind of paper much like that now in use, from cotton and other vegetable substances, and even of silk at a very remote period. Other nations claim a similar art, but none pretend to have fabricated paper out of the "odds and ends" of cloth once woven.

To whom the world is indebted for the idea of transforming the worthless fragments of waste cotton into an article so beautiful and valuable as paper, no one knows. Perhaps the discovery, like so many others, was the result of accident; perhaps some intelligent observer studied the operations of that marvellous old paper-maker, the wasp. But it is singular that we have no positive information either as to the country where, or the epoch when, paper from rags began to be manufactured in Europe. It is believed that the discovery does not date back farther than the tenth or twelfth century. It was in common use before the art of printing was discovered. This great invention would have been of little avail had not a material, cheap, neat and plentiful, been adapted to it.

Art of making paper from rags.

The rags of which modern paper is made are collected by peddlers and transferred to the paper-maker. They are sorted, cleansed and bleached by exposure to the action of chlorine which discharges all color. To reduce them to very fine fibres, they are placed in a machine fitted with knives which cut and tear them into downy particles; water is then added, making of it a pulpy mix-

ture. Portions of this are poured upon moulds or sieves of fine wire, where the water drains away, leaving the fibers on the bottom in a layer, which being consolidated by pressure, and dried, becomes a sheet of paper; its strength and goodness depending, of course, on the quality of the material of which it is made. That designed for writing paper is sized by being dipped into a hot weak glue containing a proportion of alum in solution. The sheets are then dried again, and afterwards pressed with great force to make them smooth.

Process of paper-making.

The sheets are laid in piles of twenty-four each, called a quire; twenty quires, which make a ream, or half that number, are enveloped in wrappers for sale. Writing paper is made of various sizes according to the use for which it is designed; as note paper, letter paper, foolscap, etc. Fashions in the style of paper vary as in everything else.

Writing papers.

Besides paper for writing there is a great variety for other purposes; for printing, drawing, blotting, tracing, etc., for wrapping, of different sizes, qualities and colors, the coarser kinds being made of coarse materials, old ropes, sacking, straw and other substances. Wall paper (or paper hangings) is printed much in the same way as calico and other cottons. Old worn out paper, printed or written upon, and almost all other kinds, may be restored or made over into new which is just as valuable as at first. The cheapness of paper, however, renders it quite unnecessary except

Other papers.

when there may be a great scarcity of materials for a constant supply. Paper, like cloth, may be colored any desirable shade.

Marbled paper is made by a peculiar process. A trough or bath is provided of the size of the sheet to be marbled, filled with a mucilage of gum and water. Different colors are sprinkled from brushes, on the surface of the bath where they spread of themselves. A sheet of paper is laid on the surface of the liquid and absorbs the colors just as they lie. It is then carefully taken off, dried, and afterwards polished for use.

Marbled paper.

Almost all civilized nations have varieties of paper peculiar to themselves, in character and manufacture. The Chinese use many substances for making paper; the bamboo, the inner bark of the mulberry, the outer case of the silk-worm's cocoon, etc. The celebrated rice paper is a Chinese manufacture, used much in their printing, and also for wrapping. The Japanese make paper from the mulberry, which is strong enough for cordage. They use it for tents, umbrellas, gowns, cloaks, etc., and it so closely imitates silk and other rich stuffs, that it is often mistaken for them. It is rendered water-tight by painting and-varnishing, and in this form supplies innumerable wants.

Chinese and Japanese paper.

Pasteboard is a stiff, thick kind of paper-board formed of several single sheets of paper pasted one upon another, or by macerating paper and casting it in moulds. It is used for a great variety of purposes, the most important of which is the

making of boxes. *Papier-maché* is made of pulp from rags and paper mixed with size or glue, and formed into any desired shape by moulds. Sometimes pasteboard, treated with glue and varnish, is called by this name. It is used lately in a great many ways, and is a very durable material.

Pasteboard and papier-maché.

PARCHMENT PAPER.

Parchment paper, or *artificial parchment*, is a new chemical discovery by which common paper dipped for an instant in a mixture of sulphuric acid and water, is immediately converted into a strong, tough, skin-like substance, to which the above names are applied, as it has in many cases superseded the use of the true parchment. By this treatment, in little more than a second of time, a piece of weak, porous, unsized paper is rendered firm and stout, while the chemical composition and weight of the paper remains unaltered, though the dimensions of the sheet are somewhat contracted. The nature of this change is not yet well understood. It is not affected by water like common paper, nor decomposed by heat and moisture. These qualities will render it a most useful and popular article, as it is much less expensive than common parchment prepared from skins.

Parchment paper.

BOOKS.

Printed *books* are, in all civilized nations, an article of commerce. Among people where the

masses are intelligent, and educated to some degree, the sale of books is enormous. Our English word *book* comes from the German *buche*, which means *beech*, the ancient Saxons and Germans from whom the English are descended, having been accustomed to use thin beechen boards as tablets to write upon. *Liber*, the Latin word for book, means *bark*, referring to the fibrous matter obtained from the bark of certain trees, which was prepared for writing upon by the early Romans. Our word *library* is derived from it. *Volume* comes from a word meaning *to roll*, as the literature of most ancient nations was kept in the form of *rolls* of parchment, papyrus, linen, etc. Before the discovery of the art of printing, the only method of multiplying copies of any valuable writing, was by the slow and laborious process of rewriting with the pen. This was the business of a certain class of men, who attained great perfection as well as rapidity in their work. Many copies of the entire Bible have been produced in this way, some of which now constitute objects of value, interest and curiosity in celebrated libraries and museums.

Ancient books.

Books are classed according to the mode in which the sheet is folded. If it only makes two leaves the book is called a *folio;* if folded into four leaves it is a *quarto;* if eight, it is *octavo;* twelve, *duodecimo.* No reference is made to the size of the sheet.

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publishing their works. This copyright may be purchased of the author or owner, and then the publications are the exclusive property of the buyer. Publications are sent to other countries, translated into other languages, and sold in vast numbers, for which the authors, or copyright holders can legally claim no benefit. A law regulating this matter, and securing a fair proportion of the avails of these foreign sales to the author, or the holder of the copyright, has long been urgently demanded.

Copyright.

Books of some kind are printed in all the large, and many of the small cities of the United States. The business of publication is conducted in some of them on an enormous scale, to supply the home and foreign market. The principal European cities are also noted for immense trade in books. The demand is universal.

CHAPTER XV.

PERFUMERY.

SECTION I.—ANIMAL ODORS.

MUCH value was attached from very ancient times to those substances which afforded a pleasing odor. The oldest of books, the Bible, contains repeated allusions to this fact, and gives us some idea of the materials used for the purpose. Oriental nations have always been famous for their admiration and lavish use of perfumes. At the present day they are also considered as among the necessaries of the toilet, so that the commercial importance of various articles of perfumery is very great, and the business of the perfumer a very extensive one.

Antiquity and value of perfumes.

The perfumes of commerce are derived from animal substances, as musk, civet, ambergris, etc.; from woods, as cedar, sandal-wood, and others; from gums or concreted juices, as frankincense, benzoin, etc.; from fragrant flowers, leaves and fruit, as the rose, orange, etc.; and from certain chemical sources and operations, as the derivatives of *fusel-oil*, by distillation, called "extracts."

Whence perfumes are derived.

Only a few of the numerous articles which compose the list of perfumes, can be mentioned. We commence with those of *animal* origin.

MUSK.

Musk is obtained from a species of deer inhabiting the mountains of Thibet and Central Asia generally. It is an active and timid animal of the deer kind, about three feet high, springing from rock to rock with astonishing agility to escape its pursuers, who hunt it for the hide as well as the perfume. This substance is contained in a small bag or sac under the body of the male. As soon as it is killed, the sac is cut off and dried, with its contents, and in this state is sent to market. It is of a dark-brown color, slightly oily, and adheres in grains. It has a peculiar and extremely powerful and durable odor, so penetrating and diffusive, that one part will communicate its smell to many thousand parts of inodorous powder, thereby making it easy to adulterate the true substance. This is done very extensively; dried blood or other matters resembling it, being strongly scented with musk, are often sold for the genuine which always commands a high price. Hunters are constantly employed in the mountain ranges of China and Thibet to procure this valuable product of the musk-deer. It has so powerful an odor when freshly cut from the animal, they are obliged to muffle their mouths and nostrils with folds of cloth to prevent the most injurious effect. Death

Musk.

has sometimes been the result when these precautions were neglected. The best musk is imported from China.

CIVET.

Civet is an odorous substance, obtained from the civet-cat, a native of Africa, and from another similar animal, which inhabits the East Indies. It is also brought from Africa and Brazil. The perfume, which resembles musk, is also secreted in sacs, which the animal carries behind. It is offensive unless greatly diluted, but in combination with other perfumes, adds to their energy. The civet-cat is a carnivorous animal, between the fox and weasel, from two to three feet in length, and only a few inches in hight. Numbers of them are kept for the purpose of producing the perfume, which is removed from the place of deposit periodically.

Civet.

The beaver also produces a powerful odor, called *castor*, which is used in medicine more than in perfumery. It is not very unlike musk or civet, and as it is very scarce, is often counterfeited.

Castor.

AMBERGRIS.

This substance, which is found floating on the sea, or thrown by the waves on the shores of various countries, particularly near the coasts of India, Africa and Brazil, is now generally believed to be produced in the stomach or intestines of the

sperm whale, and perhaps in those of other fish. It is found usually in small masses, but sometimes of fifty or one hundred pounds weight. It is of a gray, or ash color, with dark brown, or black spots within, giving it a variegated appearance, like marble. Ambergris is opaque, lighter than water, and of the consistence of wax. It has a peculiar, aromatic, agreeable odor. The Asiatics sometimes use it as a flavor for certain dishes, but its chief and almost its only value is as a perfume. It has been found in the body of the sperm whale, as well as floating in the sea, which fact gave the clue to its origin. By itself the odor of ambergris is much less agreeable than when blended with others.

Ambergris.

SECTION II.—FRAGRANT WOODS AND GUMS.

SANDAL-WOOD.

AMONG the fragrant woods the *sandal-wood* stands highest as an article of perfumery. The part of the tree used is the heart, which is often employed to make into small objects of ornament or convenience, sometimes ground into powder as a cosmetic, and sometimes distilled to obtain the oil. The tree grows most abundantly in Malabar and some of the islands of the South seas or Polynesia. It has been mentioned before among ornamental woods.

Sandal-wood.

RED CEDAR.

This wood has a very agreeable odor, and is much in request for trunks, wardrobes, or other articles designed for the storage of clothing. It is considered, also, as a safeguard against moths and some other troublesome insects.

FRAGRANT GUMS.

Frankincense is perhaps the most important of these, and was anciently considered of great value. It is produced by a tree which grows in central India, and is called the Olibanum. It is a lofty tree, with the foliage crowded at the extremity of the branches. The gum exudes from incisions made in the bark, in the form of semi-transparent tears, of a pale yellow or pink color, solid, hard and brittle. When heated, the gum burns brilliantly and diffuses an agreeable odor. In ancient times it was much used as incense in religious rites, and in modern days the Greek and Roman churches still retain the use of it in their ceremonies. It was among the most precious substances known to the Orientals.

Frankincense.

Sandarach is another gum from the north of Africa, often used for the same purpose. *Benzoin* comes from Sumatra, Java, Borneo, etc. It is procured from the tree in the same way as the others. It is used in medicine, and as a cosmetic. The Hindoos burn it as a perfume in their temples.

Sandarach and benzoin.

SECTION III.—EXTRACTS FROM FLOWERS, LEAVES AND FRUIT.

THE most delicate and exquisite odors are those obtained from flowers, leaves and fruit, of various kinds. This is done mostly by distillation, by which process the particles of fragrant volatile oil, which these substances contain, are separated by the steam of the apparatus and afterwards collected at the other extremity of the still. From the petals of the rose is produced in this way the *attar or oil of roses* so costly that very few can enjoy its sweetness. The flowers from which it is obtained are cultivated in the East Indies, Egypt, etc., for this purpose, as those growing in colder latitudes yield such a minute quantity of oil that they are of little value. The petals are carefully distilled over and over, and this oil is then found on the surface of the water. Sometimes they are steeped, and the water allowed to stand in the sun, when the oil rises to the surface and is removed by a little wisp of cotton, from which it is squeezed into a small vial and closely stopped. It is said that one hundred thousand roses yield only a few grains of the attar. The oil is greenish at first, but becomes darker by keeping. The water distilled from rose leaves is also valued as a perfume. It contains less of the flavor of the flower, but is very delicate and inexpensive. The dried petals, pulverized, also give fragrance to sachets. In a similar manner the volatile oils are derived

Attar of roses.

from other fragrant flowers and leaves. The orange, jasmine, violet, lily, tuberose, lavender, geranium, the mints, etc., etc., are thus made to yield their perfumes. Many of the flowers that produce them are cultivated in large plantations for the purpose. Orange blossoms are procured from Sicily, Calabria, and the south of France; violets from the gardens of Nice; tuberoses from the environs of Genoa; jonquil and narcissus from southern Europe and northern Africa, etc.

These oils are all soluble in alcohol, and the art of the perfumer blends them into compounds to which many fanciful names are applied. The well-known *Eau de cologne* is a mixture of many volatile oils and essences in pure spirit. The numerous counterfeits of this once delightful perfume have impaired its popularity and given precedence to various other mixtures.

Compounds and fancy perfumes.

CHEMICAL ODORS AND EXTRACTS.

But while the delicate odors were formerly derived entirely from fruits, flowers and leaves by the processes described, the chemistry of modern times has taught us how to obtain them from other sources; and at the present day many of the most agreeable and popular of them all are produced by chemical means, from substances, some of which are loathsome and disgusting. But it is the highest triumph of science and art to convert what is useless and odious, into materials at once valuable and desirable.

Odors chemically produced.

In the process of distilling whiskey from grain or potatoes, there is generated a peculiar oily liquid of a pungent and most disagreeable odor, called *Fusel-oil* or *Amylic alcohol.* By distilling this loathsome oil, under proper circumstances, with various acids, certain odoriferous compounds are obtained, which, during the last few years, have been familiarly known as "*fruit extracts*" or essences, and "*liquor-flavoring materials.*" The odor of the pear, apple, orange, banana, and many others are so perfectly reproduced that these preparations have come into popular use. The oil of pine-apples is produced from sugar and putrid cheese. Certain others are derived from coal oil or gas tar. Some of the daintiest odors for the toilet have an origin still more disgusting. But in all these cases there is not the same kind of fraud which is practiced in ordinary adulterations; for though the perfumes are not actually produced from the flowers and fruit which give them their names, yet they are considered identical in chemical composition with the original perfumes which nature elaborates in the fruits and flowers themselves; nature mixing the ingredients in one case, and art in the other—the ingredients being the same.

Odors from fusel-oil, etc.

Not adulterations.

The passion for perfumes is constantly increasing, and the revenue derived from foreign importations is very considerable. The largest income from some estates on the borders of the Mediterranean is derived from the

Revenue from perfumes.

sale of orange flowers and violets, certain noted perfumers of Paris paying a large annual sum for the entire crop. The art is carried to the greatest perfection in France, many of whose manufacturers, as Lubin, Faguer, and others, have a world-wide popularity.

CHAPTER XVI.

EXPLOSIVE SUBSTANCES.

GUNPOWDER.

THE invention of gunpowder is by many writers ascribed to Berthold Schwartz, a monk and alchemist, of Freiburg, in Germany, in the fourteenth century. Others believe it to have been known to the Chinese at a much earlier period. Neither is it certain when or by whom it was first applied to the purposes of war, but at the end of the fourteenth century it had come into use to some extent.

Invention of gunpowder.

Anciently, when men fought hand to hand with swords, spears, axes and clubs, or at greater distances with arrows, javelins, or other pointed missives, the destruction of human life was fearful. The use of gunpowder with artillery has changed the whole nature of warfare, and by interposing distance between the combatants, has greatly diminished the number of its victims, not one discharge in hundreds taking fatal effect; so that dreadful as its mission may be as a destructive agent in battle, it has

Gunpowder in war.

probably preserved many lives that would have been sacrificed by the use of the primitive weapons.

Gunpowder is composed of three ingredients, nitre (or saltpetre), sulphur and charcoal. These are pulverized separately, and then mixed in the proper proportions, which are one part nitre, one part sulphur, and three parts charcoal. They are then slightly moistened and further ground and blended together, before being subjected to an immense hydraulic pressure. This operation forms the mixture into a thin, hard cake, which is afterwards broken up into small fragments, or granulated. The grains are sorted by means of sieves of different fineness, and then thoroughly dried for use.

Composition of gunpowder.

Each ingredient of gunpowder has its special office. The sulphur easily takes fire; the charcoal retains and makes it fiercer, while the nitre explodes with such force as to carry everything before it.

Gunpowder is also used in immense quantities for blasting purposes. Great care is required in its manufacture and storage. The operations at powder-works are distributed as much as possible in numbers of isolated buildings, on account of the danger of explosion.

Gunpowder is made by most civilized nations of the present day, and its use has become nearly universal.

GUN-COTTON.

This is another highly explosive material discovered within a few years. It is made by soaking

perfectly clean cotton for a few minutes in a mixture of nitric and sulphuric acid. The cotton is then washed and dried by exposure to the air. It still retains the appearance of cotton but has gained in weight, become harsh to the touch, and electric. It can be used in fire-arms like gun-powder, only as its explosive force is four times as great it must be employed with caution. There is so much danger of bursting the gun and of accidental explosions, that it is rejected for most practical purposes.

Gun-cotton.

When dissolved in a mixture of ether and alcohol, gun-cotton forms a powerfully adhesive substance, called *collodion* which is used as a plaster in surgery. Collodion is employed also in photography.

Collodion.

NITRO-GLYCERINE.

This is also a recently discovered chemical combination of glycerine (an oily sweetish fluid existing in fats) with nitric acid. It is often called "*blasting oil*," and has been used to some extent for blasting purposes instead of gunpowder, as it possesses terribly explosive properties. It is a pale yellow, oily liquid, heavier than water, and soluble in alcohol and ether. Perhaps it may prove a very useful substitute for gunpowder when its characteristics are better understood. But as it has frequently exploded without known cause, doing immense damage to life and property, it is not considered a safe article of transport or of general use.

Nitro-glycerine.

Greek fire is a combustible and explosive composition which burns under water, the constituents of which are supposed to be nitre, sulphur and asphaltum.

Other explosive compounds known as *fulminating powders*, are used in the manufacture of percussion caps. They are of so dangerous a character that the chemists who make them and understand their nature, are often severely injured and sometimes killed in experimenting with them.

CHAPTER XVII.

ELASTIC GUMS.

CAOUTCHOUC, GUM-ELASTIC OR INDIA RUBBER.

THE substance known by these names is the hardened juice of a large tree growing in Brazil, Guiana and some parts of Central America. Several trees produce this gum, but none of the quality or in the quantity of the *Jatropha elastica*, as it is named in botany. It is obtained by wounding the tree, when the milky juice flows out, and hardens by exposure to the air. The dark color is imparted by the smoke of the fires over which the fresh product is dried. When pure it is of a light color, and transparent, in thin slices. It comes to us in large, flat pieces, or moulded into various shapes, which are formed by applying successive layers of the juice to moulds of clay. These moulds are removed by being broken up when the coating is sufficiently thick. Most of the caoutchouc at present used in manufactures, is obtained from the country lying upon the Amazon, in South America. The juice is sometimes brought in its natural condition, in

Derivation of this gum.

tightly corked bottles, mixed with a little ammonia, which prevents its hardening.

The properties of this substance are well known. Its great elasticity adapts it to many very useful purposes. Boots and overshoes, covers, cushions and pillows filled with air, surgical bandages and instruments, and numberless other articles. It is also cut into threads, and woven into various elastic fabrics, braces, cord, tape, etc. It is dissolved in naphtha, benzole, oil of turpentine, ether, and may then be applied in thin coatings to cloth or other surfaces, rendering them water-proof.

Uses of India rubber.

That most useful fabric called *Macintosh cloth*, after its inventor, is made by cementing two layers of cotton or linen with India rubber, reduced to a paste-like condition. The two pieces after being separately coated, are placed face to face with great care, to prevent creasing or wrinkling. They are then pressed so thoroughly as to make them unite permanently into a firm and durable water-proof cloth, which can be shaped into garments of any size or pattern. They are exceedingly neat, convenient, and serviceable during exposure to wet weather.

Macintosh cloth.

When caoutchouc is heated with sulphur it undergoes a remarkable change, becoming what is called *vulcanized rubber*. In this condition it is less liable to be hardened by cold or softened by heat. From this form of the material almost all India rubber goods are now fabricated. Mixed with a proportion of bituminous

Vulcanized rubber.

or pitchy matter, and some other ingredients, it is converted into a hard, black, shining substance which works like ivory, and is extensively used for the manufacture of combs, pencil-cases, knife-handles, etc.

GUTTA-PERCHA.

This valuable substance has only been known within the last few years, the first specimen of it having been sent to England in 1843. It is the juice of a large tree which flourishes in certain parts of the Malayan Archipelago and is chiefly obtained from Singapore. The name belongs to the Malay language; *gutta* meaning the gum itself, and *percha* the tree from which it is procured. This tree rises to the hight of sixty or seventy feet with a trunk three or four feet in diameter. The foliage is of a pale green on the upper surface, and covered with reddish brown hairs beneath. The milky juice which exudes from the tree hardens on coming to the air and is of a dirty white color.

Gutta-percha tree.

This substance has some properties in common with india rubber, but possesses others of its own which render it invaluable in the arts. The Malays have long used it for fabricating various articles, whips, jugs, basins, shoes, etc., which have from time to time attracted the attention of travelers, and brought to notice the native mode of manufacture. This was to soften the gum in hot water and then mould it into any desired form which it permanently retains on cooling.

Native use of the gum.

This property of gutta-percha adapts it to a great variety of uses and imparts to it a value equal, if not superior to that of caoutchouc. It comes in lumps or blocks of several pounds weight, often containing impurities, stones, earth, etc., introduced by the Malays for the purpose of increasing the weight. After these are extracted by cutting up the lumps under rotating wheels, armed with knives and teeth, it is ready for working, being kneaded into a paste in hot water, and afterwards rolled out into sheets between steel rollers, or made to pass through heated iron cylinders.

Preparation of the gum.

The uses of gutta-percha are too numerous to specify. Only a few of the most important can be mentioned. It resists the action of water, and is at the same time a bad conductor of electricity; it is therefore employed for enclosing the metallic wires used in the electric telegraph. The efficiency of the submarine telegraph is largely due to this valuable substance. Buoys, life-boat apparatus, etc., are made of it, as well as bands and straps for machinery, tubes, buckets and many other articles valuable to the manufacturer, architect, and surgeon. The speaking tubes of gutta-percha used on railways, in mines and other situations where distance intervenes, are very valuable, on account of its property of conducting sounds. Stereotype plates have of late been made of gutta-percha. A mold is taken by pressing a page of type with woodcuts into it while in a softened state; a cast is thus obtained from

Uses of gutta-percha.

which the printing is done. The dentist employs this substance as a plate for artificial teeth; the chemist, physician and surgeon use it in various ways; it is also extensively manufactured into numberless articles of use or ornament.

Certain other plants yield a substance similar to gutta-percha in some respects, but none combine all its valuable properties.

CHAPTER XVIII.

OILS, CANDLES AND SOAPS.

OILS.

OILS are of two classes: *fixed oils* and *volatile oils*. Fixed oil, otherwise called fat or expressed oil, is derived both from animal and vegetable substances by heat or pressure. *Whale* or *train oil* comes from the blubber of the whale, seal, and other fish; *lard* from the swine, and *tallow* from cattle and sheep. Many *fruits*, *nuts*, and *seeds* yield oil by simple pressure. The olive, the almond, the palm, the seeds of the poppy, flax, hemp, sun-flower, and a great many others produce it in large quantities. From certain oils of this class, the drying oils for the use of the painter and printer are prepared, by heating till they lose much of their greasy property. Linseed or flaxseed oil is much employed in paint for buildings. Nut oil is preferable to all others for printing ink.

Fixed oils.

Fixed oils are generally liquid, or very easily become so by gentle heat. They have a bland taste, little odor, if pure, are insoluble in water, and

nearly so in alcohol, and leave a greasy stain upon paper.

Many of the fixed oils are used for burning in lamps, and other illuminating purposes, though the use of kerosene has superseded them in many places in this country. The oil of the palm and olive are largely used as food. The first is obtained from various species of palm where they flourish naturally, growing in tropical countries; the second from the olive tree, which abounds in the south of Europe.

Uses of the fixed oils.

Volatile oils are derived entirely from vegetable sources; from the root, bark, leaves, wood, flowers or fruit of a great variety of plants. These oils are distinguished from fixed oils by their greater liquidity, their strong taste, powerful odor and their property of evaporating so as to leave no stain or grease spot. They are soluble in alcohol, and are used in medicine, perfumery, cookery, etc. Sometimes the oil is obtained by pressure, as from the peel of the orange, lemon, bergamot, etc., but generally by distillation of the parts of the plant containing the oil. All the fragrance of the vegetable world resides in these volatile oils, which are numerous and various beyond description.

Properties and uses of the volatile oils.

CANDLES.

Candles are artificial lights made of tallow, sperm, wax, (and other materials discovered by modern science,) over a wick of linen or cotton threads,

twisted or plaited loosely together. They are an article of considerable commercial importance.

Tallow candles are sometimes dipped, that is, immersed repeatedly in melted tallow till they are of sufficient size. These serve for family use; but the better sort are made in molds; these being filled with tallow, which cools and hardens round the wick, which occupies the centre of the mold. Tallow candles.

Spermaceti is a fatty substance found in the head of the sperm whale. The head of this animal is enormously large in proportion to the rest of its body, and will often yield ten or twelve barrels of crude spermaceti. Being dug out from the cavity of the head, the oil is separated from it, and the residue is a white, crystallized, brittle, semi-transparent substance, which bears this name, and is manufactured into candles, as well as used in medicine and cosmetics. The real nature of spermaceti was not known for a long time; but it is now considered the brain of the whale. Spermaceti.

Candles are also made of *wax*. Several plants contain wax in such abundance that it is extracted for various uses. The Chinese make candles from some of these, which burn brilliantly, and have a very agreeable odor. But the wax of commerce is the product of the bee. The honey is first pressed from the comb, and the wax of which it is composed is then cleansed and melted into cakes. Wax has a slight odor of honey, and is of a yellow color, but may be bleached by being exposed in thin slices to light, air, and moisture. Wax.

It can also be decolorized by the action of chlorine, but in this case it does not answer for the manufacture of candles, which is one of its principal applications.

Wax candles are made by suspending the wicks upon a hoop over the caldron of melted wax, which is repeatedly poured over them from a ladle till they have acquired their proper size; the upper end is then shaped, and the lower cut off. If cast in moulds they burn irregularly. The wax is often adulterated with spermaceti and other substances. It is the most expensive of illuminating materials. Wax is also used in medicine, soap-making, and other ways; some ornamental and some useful.

Wax candles.

The celebrated French chemist Chevreul discovered that fat was composed of three highly inflammable elements which have been named *stearine*, *margarine* and *oleine*. The first two are solids, the last a liquid, with which the solids are combined. Another principle has also been found in oils by chemical analysis, called *glycerine*, or the sweet principle of oils. These may all be separated and the solids (margarine and stearine) made into candles, leaving the liquid constituents (oleine and glycerine) for other purposes. This application of scientific and chemical research has created great changes in the candle manufacture; and very beautiful and valuable candles are now commonly produced from these substances, at a very moderate price. Stearine is obtained mainly from tallow and lard.

Stearine candles.

Paraffine is a substance obtained from oil of tar, by distillation. It resembles spermaceti and is also used for candles. In a liquid form it is useful for lubricating machinery. Paraffine.

Glycerine is a sweet, syrupy liquid, readily soluble in water and alcohol. It has been in use only a few years, and is now considered a very valuable substance, having remarkable solvent and antiseptic properties which surpass those of alcohol. It also possesses much value in medicine. It may be obtained from tallow by heating it with lime, and by other processes. Glycerine.

SOAPS.

Soap may be reckoned at the present day almost as one of the necessaries of life though it was imperfectly known to the ancients, and its consumption is chiefly confined to civilized life. Pliny informs us that it was first invented by the Gauls and was composed of *ashes* and *tallow*. Importance of soap.

Soap is of two kinds, hard and soft. Hard soap is made of tallow or oil, with soda for its alkaline constituent. It has a whitish color, and is sometimes called *white soap*. Rosin is often introduced, and this mixture forms the *yellow soap* of this country. *Castile soap*, if genuine, is made of olive oil and soda, its mottled appearance being produced by the addition of oxyd of iron. Hard soap.

The *fancy soaps* are made of these materials in

general, with the addition of perfumes of various kinds and certain coloring matters.

Soft soap is made of oil or soft grease with *potash* for an alkali. Whale or train oil is much used for this purpose as well as other cheap oils, and refuse grease. It never becomes hard and solid like the soap made with soda. Its properties for cleansing are much the same, but it is cheaper, and generally made by families in the country from their own materials and for their own use.

Soft soap.

CHAPTER XIX.

PINS, PENS, PENCILS, FANS AND MATCHES.

PINS.

PINS are made of brass drawn out into wire. To do this the bar of metal is forced through a hole in an iron plate, which is a little too small for it, and which of course reduces its size, but adds to its length. It is then drawn through another hole still smaller, and so on till the wire is of the required fineness. It is next made perfectly straight, and then cut into lengths, each sufficient to make six pins. These are ground to a point at both ends by boys, who have two grindstones before them, one coarse and the other fine. They take up a handful at a time, and keep them moving in their fingers till the points of all are applied to the stones. The length of a pin is then cut from each end, and the blunt ends of the remainder sharpened as before, and cut again, till the six pin lengths are taken off.

Process of making brass pins.

The heading of the pins is the next process. Formerly, the heads were of wire coiled for the purpose; they are now generally solid, and do bet-

ter service than the wire heads which often came off. But the mode of applying the wire to the head was curious. A straight wire was used to twist another wire upon, and this twist was cut up into bits, each just large enough for the head of a pin. The straight wire being drawn out, these bits were now all prepared for the head, having a hollow ready to insert the blunt end of the pin into. The pin-maker (generally a child) thrusts the end into a coil, and then on a small anvil before him, hammers the head to fasten it in its place. All this is done with great precision and dexterity.

Heading of pins.

The pins are now made, but are of the color of the brass wire. To give them whiteness they are placed in a solution of tin mingled with certain other substances, where they remain awhile, till the tin fastens upon the brass. When taken out they are dull, and must be polished. This is done by putting them into a vessel of bran, which is made to revolve with great velocity. This scours them till they are sufficiently bright, when the bran is winnowed out and the pins left ready to be arranged in papers for sale. The modern processes of pin-making are all accomplished by machinery.

Whitening and polishing of pins.

To make pins black for mourning dress, and many other purposes, they are often coated with a black varnish of Japan. Made of steel wire, and headed with a globule of black glass, they are very pretty and useful. They are not liable to bend, on account of the temper of the steel,

Black pins.

which also takes a much sharper point than copper wire.

Pins are manufactured very extensively in England, France, and other European countries. In this country they are also made, of good quality, in various places. Many boys and girls are employed in this business, as the work is light and easy.

Where pins are made.

The uses of this neat little implement are too well known to need even an allusion. It is difficult to understand how people ever managed to do without pins.

Improvements in the manufacture are made from time to time.

PENS.

The *pens* used for writing with ink were, till within a few years, made from the quills of the goose, swan, and other large birds. It is said they came into use as long ago as A. D. 553. Those most used are plucked with great cruelty from living geese. But recently, metallic pens, of steel, copper, silver, or gold, have been in popular use, and are manufactured in immense quantities both in Europe and this country. But it is difficult to impart to metal the elasticity of the quill, and many people still prefer to use it.

Pens.

For the manufacture of steel pens the best metal is selected, made into thin leaves of the thickness which will give the requisite flexibility to the pens. These thin slips are then subjected to the action of a stamping press, which shapes the pens. The

point destined for the nib is next introduced into a hole of a small machine where it is pressed into the proper curve, and pierced with the middle slit. Pens are afterwards cleaned by being tossed about among each other in a revolving cylinder, where the mutual friction imparts a polish. Steel pens are sometimes punched out of the softened sheet of steel, and then tempered by being heated in an oil bath.

Metal pens. How made.

PENCILS.

The word *pencil* is used in two senses. It signifies either a small brush of hair employed by painters in oil and water colors, or a slender piece of black lead (or plumbago), used either naked or enveloped in a wooden case. The best are made by sawing the plumbago, which has been previously prepared by heating, into the proper form, and encasing in cedar wood. The plumbago is also used alone in cases of gold, silver, gutta percha, etc., provided with a mechanism to protrude a minute portion. These are called ever pointed pencils, and are often elegant and expensive. The term *crayon* is often applied, not only to the common pencils, but to larger articles for sketching and drawing; some black, and others of different colored chalk.

Pencils and crayons.

Slate pencils are cut from fine pieces of slate, and rounded into a convenient form for the scholar's use in ciphering, writing, drawing, etc.

FANS.

Fans are well known implements to produce coolness by agitating the air. They are a very ancient invention, being found painted on the walls of tombs at Thebes, in Egypt, showing their use more than 3,000 years ago. Old writers, too, mention them in describing the customs, or illustrating the usages of antiquity. The forms were different, but some were very beautiful. Catharine de Medicis, introduced the fan in France, where it has long been an article of manufacture and commerce. The Chinese are the only great rivals of the French, and the two nations have in a good degree, the monopoly of the business. In China, the manufacture is chiefly confined to Canton and a few other towns. In France, Paris is the chief center of the fan business, which gives employment to a great number of men, women, and children. Some of the fans are exquisite works of art and skill, and command very high prices.

Antiquity of fans.

French and Chinese fans.

The Chinese and Japanese, produce the lacquered, bamboo and palm-leaf fans, sometimes of large size to serve for parasols. The palmetto, with the natural stem for a handle, is a very durable, cheap, and convenient fan.

MATCHES.

As an article of universal use and indispensable convenience, there is scarcely anything which equals

the *friction match*. It has superseded all the old, clumsy, and uncertain methods of producing fire, which have been employed for ages, giving in their place a neat, reliable, safe, and cheap article, always at hand, and always ready for service. The flint and steel, the tinder-box, the phosphorus bottle, and many other imperfect inventions of former days have all disappeared, or are only preserved as curiosities.

Importance of friction matches.

Many improvements have been made in the manufacture of matches since they first came into use, and doubtless others will follow. The *Lucifer matches*, as they were called, were the first that operated entirely by friction. They were tipped with a paste of chlorate of potash, and sulphuret of antimony, mixed with starch, and were ignited by drawing the match between surfaces of sand paper. In the year 1834, phosphorus was substituted in place of antimony; and afterward, nitre, or saltpetre, took the place of chlorate of potash, which produced quiet ignition instead of detonation.

Lucifer matches.

The common method of making matches at present, is the following: The splints are of pine, sawed by machinery into the proper form. The ends of these splints are just immersed in melted sulphur, a thin coating of which adheres to each. After being well dried they are dipped in a composition made of phosphorous, saltpetre, and some coloring material mixed in a hot solution of gum or glue. If the tips

Method of making common matches.

are to be red, vermilion is used; if blue, the color is given by Prussian blue.

In firing a match, the phosphorus is first ignited by the friction of rubbing on any rough surface; the heat occasioned by it decomposes the saltpetre and increases the heat so that it ignites the sulphur, which in turn inflames the wood. Firing a match.

Phosphorus, one of the most important ingredients in the match manufacture, is obtained from bones, by burning and subjecting the ashes (called bone-ash) to certain chemical processes, which separate the phosphorus from the lime of the bones. Phosphorus.

Matches are put up in various ways for market, in boxes and packages of many sizes. They are a very important article of commerce, and are sent all over the civilized world.

CHAPTER XX.

CLOCKS AND WATCHES.

CLOCKS.

THE origin of clock-work and of clocks is very obscure; and although learned men have investigated the subject carefully, it is not certainly known when or by whom they were first invented or used. The clepsydra or water clock, used by the ancient Romans, was perhaps one of the first instruments for measuring time aside from the sun-dial. These are supposed to have been vessels of water with a small aperture in the bottom through which the water ran out in a certain time, after which the vessel was again filled to be emptied as before. The hour-glass was another means of measuring time which with other instruments constructed on a similar principle were long in use. Alfred the Great adopted the burning of a taper to mark the lapse of the hours; so much length consumed, indicating so much time. Some of the very rude tribes of Africa and of the South Sea islands, burn an oily nut to show a certain length of time. A number

Clepsydra or water clock.

of these nuts strung together and successively burned, afford not only light when needed, but a means of calculating the advance of day or night.

What were called clocks in the ninth or tenth centuries do not appear to have borne much resemblance to the instruments known by that name for the last five or six hundred years; the action of these being produced by weights or springs operating upon a train of wheels. The earliest complete clock of which we have any certain record was made by a Saracen mechanic in the thirteenth century. There is one now in existence at Dover Castle in England, bearing the date 1348, which is perhaps the oldest known. Ancient and modern clocks.

Clocks at the present day are made of a great variety of models, to suit different tastes, and to be applied to different purposes. The Germans, Dutch and Americans are particularly skilled in this manufacture. The English, French and Genevese have carried the art of making brass clocks to great perfection. In this country an immense number of small wooden clocks have been made and sold at a low price, some of them doing excellent service for years. Clock manufacture.

The cases of clocks are of wood, marble, malachite, metal, papier-maché and other ornamental materials, some extremely costly and elegant, especially those designed for the mantel. Some run many days, others require to be wound up every day. Some are dependent on weights, others upon spiral springs. Many Clock-cases, etc.

of the tall old-fashioned *eight day clocks*, after going for a hundred years, are still among the most accurate of time-keepers.

Clocks, from their great convenience are a very considerable article of commerce; but not a profitable one to many manufacturers, as the cost in numerous instances has exceeded the profits. The number of clock-making establishments has consequently diminished of late years, especially those which have constructed the cheaper kinds.

WATCHES.

When constructed on the most approved principles, and executed in the best manner, a *watch* is not only an exceedingly useful, but a most admirable piece of mechanism. And considering its small size, its capacity of being carried about uninjured in every variety of position, the number and complexity of its movements, and the accuracy with which it measures time, it may very justly be considered one of the most striking specimens of human ingenuity.

Mechanism of the watch.

The motions of a watch are generally regulated by a spiral spring, and the mechanism constructed on much the same principle as pendulum clocks, the spring taking the place of the pendulum. The invention of spring watches dates from about the middle of the 16th century, and is generally ascribed to Huyghens, a celebrated mathematician of Holland. Improvements have been going on ever since, and owing to

Invention of spring watches.

the facility with which longitude may be determined by accurately going watches, it is of great importance to have them made as perfect as possible. Rewards and prizes, therefore, have often been offered to stimulate effort in that direction. And these efforts have been successful; for to such perfection has the manufacture attained, that some of the chronometers employed by navigators, though carried into the most opposite climates, have not varied to the extent of *two seconds* in their mean rate of going throughout the year. Watch-making is largely carried on in London; where artists in the business have attained a high degree of excellence. Liverpool, Coventry, and Edinburg, also furnish many excellent watches. On the Continent some of the most extensive manufactories are in Paris, Geneva, and Neufchatel.

Accuracy of chronometers.

Paris and Geneva watches are largely imported to foreign countries, and are in high estimation among the ladies. Many of them are very small and exceedingly beautiful in style and finish, and withal good time-keepers. Great numbers of European watches are sent to China; and it might be mentioned as a curious instance of the diversity of tastes, that the Chinese, and other Orientals who can afford it, uniformly prefer to wear watches *in pairs*. This sort of extravagance, however, is not confined to watches, but extends to a variety of other articles.

Paris and Geneva watches.

In this country the watch manufacture has recently commenced, but promises in time to rival

many of the old world productions. In Waltham, Massachusetts, an extensive establishment is in operation for making watches of a new style, and much more simple and durable construction than those of foreign manufacture; the different parts of the mechanism being made by machinery. These watches are already in extensive use, and are highly valued as time-keepers. Other manufactories in New England and elsewhere, are in successful operation.

The Waltham watch.

CHAPTER XXI.

TOBACCO, HASHEESH, BETEL, ETC.

TOBACCO AND PIPES.

THE *tobacco* plant is a native of America, but is cultivated in many other countries. It grows to the hight of five or six feet, with a hairy and clammy stem. The leaves are large, the lowest being of the least value. When fresh they possess little odor or taste. When ripe the plants are cut off above their roots, and dried under cover. The odor now becomes strong and the taste bitter and acrid. The leaves are stripped off, sorted and packed in hogsheads for export. When well cured they are of a yellowish green color.

Tobacco plant.

Tobacco is used in various ways. The leaves, rolled up in a peculiar form, constitute *cigars* for smoking. Ground to a powder, they are used as *snuff*, while for chewing, the leaves are pressed into cakes and masses, or reduced to small fragments for the pipe.

Forms of use.

This plant contains principles which are among the most virulent poisons known. By various proc-

esses these may be extracted. To the most important of them the name of *nicotin* is given, from that of *Jean Nicot*, who, in 1560, sent seeds of the plant from Portugal, where he was at that time the French ambassador, to Catharine de Medicis, thus introducing it into France. The botanical name *Nicotiana Tabacum*, is also derived from the same source.

Tobacco was discovered by the Spaniards in St. Domingo in 1496. It was first carried to England in 1565 by Sir John Hawkins, or Sir Walter Raleigh, and has ever since been growing in importance as an article of commerce, having been introduced more or less into every part of the world. The taste for this substance, therefore, though only apparently to minister to a frivolous gratification, has given rise to one of the most extensive branches of commerce, and has been a powerful spur to various forms of industry.

Origin and importance.

The name is thought by some to have been given in consequence of its early importation from *Tobago*, one of the Caribbee islands. Others think it received its name from *Tabaco*, a province of Yucatan; still others, that it was so called from *Tobasco*, in the Gulf of Florida. But Humboldt has shown that *Tobacco* was the term employed in the Haytian language to designate the *pipe* used by the natives in smoking; the name having been transferred by the Spaniards to the plant itself, and adopted by other nations. Tobacco is at present cultivated in the tropical climates of

Name.

both hemispheres, although it thrives well in temperate regions. Its growth is exceedingly rank, and it exhausts a soil in a short time. Its market, in various forms of preparation, is literally *everywhere.*

Pipes for smoking tobacco are of various forms and made of various materials. The Calumet of the Indians was composed of a bowl formed of a soft red stone for containing the tobacco, and a long hollow reed ornamented with feathers. Calumet.

The cheapest and most common pipe in use at present, is made of *pipe clay.* It is formed like other articles of earthen ware, and then baked in a furnace. Such pipes are not durable on account of the brittleness of the stem, but as they are very cheap they can readily be replaced when broken. Clay pipes.

MEERSCHAUMS.

The clay of which these pipes are made, is procured chiefly in Turkey, in Asia, in southern Europe, especially at Natolia, and in certain localities in England. It is a white, earthy substance, soft, but dry to the touch, and adhering, if applied to the tongue. It occurs in kidney-shaped nodules, and when first dug up it has a greasy appearance, and lathers like soap. It is sometimes used in place of soap by the inhabitants of countries where it is found. The well known Turkey tobacco pipes called meerschaums, (the word means sea foam,) are

made from this clay by a process similar to that for making pottery ware. They are afterwards soaked in a liquid composition of wax, oil and fat, the absorption of which occasions the rich coloring they acquire by smoking. Carving and polishing is a part of the finish. The fragments and parings are reduced to powder, boiled and moulded into blocks, from which bowls of less value are cut, called *massa bowls*.

Meerschaums.

Mouth-pieces of amber are often attached to the meerschaums, especially in Turkey where amber is greatly prized as a substance incapable of transmitting infection; to which those Orientals are liable who deem it a mark of politeness to pass the pipe to a stranger. The hookah, whose long, flexible stem is made to pass through water to cool and render the smoke more agreeable, is also furnished with an amber or silver mouth-piece. These pipes and mouth-pieces are manufactured to a great extent in Prussia, and are often costly and elegant.

Mouth-pieces of amber.

HASHEESH.

In India and other Eastern countries, a certain species of *hemp* is used in a manner similar to tobacco. The dried leaves are smoked for the peculiar properties they contain. A gummy substance is also obtained by boiling both leaves and flowers with a little fresh butter, which has long been employed to produce exhilarating or stimulant effects. This is called *Hasheesh* in the

Hasheesh.

language of the country; and in large quantities, or very frequent doses, it brings on a kind of delirium not unlike the effects of opium.

BETEL.

Another substance is also largely and almost universally used in the East for chewing. This is the *betel leaf* which grows on a climbing plant of the pepper family, and somewhat resembles the ivy. This leaf is used to wrap up a nut called the *areca nut* (which is the fruit of a species of palm,) with some other ingredients, the whole forming a small mass called *betel*, which almost every man, woman and child is accustomed from infancy to chew. It is very astringent, reddens the saliva, and blackens the teeth.

Betel.

Betel is a very important article of Eastern traffic. In the gardens of Ceylon the areca palm is planted near the wells and fountains while the betel vine, which immemorial custom has associated with it, is frequently seen twining about its trunk. This palm bears a strong resemblance to the cocoa-nut tree, but is of a still more graceful form, rising to the hight of forty or fifty feet, without any irregularity upon its polished stem, which sustains the crown of feathery foliage; and clustered within the graceful leaves are the astringent nuts for which it is so carefully cultivated.

COCA.

The explorations of modern travelers have brought to notice another plant containing proper-

ties which should rank it with those we have just described. Although it is at present little known in commerce, yet it will doubtless become so, and at no distant day assume a conspicuous place in the markets of the world.

Coca, as it is called, (to be carefully distinguished from *cocoa* and *cacao*) is a shrubby tree growing on the eastern slopes of the Peruvian and Bolivian Andes in South America. It bears glossy green foliage and white blossoms ripening into small scarlet berries. But it is the leaves which constitute the valuable part of the plant. They are stripped from it when brittle enough to break on being bent, dried in the sun and closely packed in sacks. New foliage soon appears for a second crop. The coca is cultivated in plantations which require to be renewed once in eight or ten years. It flourishes best in damp situations protected from the scorching rays of the sun. For this purpose maize is often sown between the rows of coca shrubs, to shelter them by its rapid growth, during the hottest part of the season.

The coca plant.

The natives of Peru and the adjoining countries esteem coca one of the prime necessaries of life; and among them its use is habitual and universal. A recent traveler says, "No Peruvian native is even seen without his leathern pouch filled with a provision of the leaves and containing a small box of powdered unslaked lime. He rests from his work at least three times a day to chew his indispensable coca. Carefully taking a few leaves from his bag, and removing their midribs, he first masti-

cates them into the shape of a small ball which is called an *acullico;* then repeatedly inserting a thin piece of moistened wood into the box of lime he applies the powder which adheres to it to the acullico, until the latter has acquired the requisite flavor. The saliva, which is abundantly secreted while chewing the pungent mixture, is mostly swallowed with the juice of the plant. When one acullico is exhausted another is prepared, for one seldom suffices. The taste is slightly bitter and aromatic, but the addition of lime renders it less disagreeable even to the palate of a foreigner, who tries it for the first time."

Use by the Peruvian Indians.

Another traveler states that the Indians who regularly use this substance, require but little food, and that when the dose is increased they are able to undergo the greatest fatigues and privations. Some of them reach a very advanced age using it freely every day of their lives. It is even thought to obviate, by its tonic effects, the cause of their principal maladies. As an illustration of the strengthening properties of coca, the case is mentioned of an Indian employed by Tschudi (a traveler in Peru) in certain most laborious excavations, for five successive days and nights, who ate nothing during the time, and slept only a little at night. But every three hours he chewed about half an ounce of the leaves, and constantly kept his acullico in his mouth. When the work was done this Indian accompanied Tschudi during a journey of twenty-three leagues over the high mountains and plains, running beside his mule

Properties of coca.

and never resting except to prepare an acullico. He was sixty-two years old, and had never been sick in his life. He assured his employer that he would willingly perform the same labor again provided he could have a plentiful supply of coca.

The same traveler, Tschudi, often used it himself, and found it to prevent the difficulty of breathing experienced in ascending to great hights above the level of the sea. It also supplied to him the place of food by imparting a sense of fulness or satiety; his appetite returning after a considerable interval.

These are the effects of a moderate use of the plant. Its abuse and excess are attended with the same deplorable consequences as are observed in Oriental opium eaters, smokers and drunkards. They are thus described: "The confirmed or intemperate coca-chewer is known by his uncertain step, sickly complexion, hollow, dull, black-rimmed eyes, trembling lips, incoherent speech, and helpless apathy. He is irresolute, suspicious and false; in the prime of life he has all the appearance of old age, and in later years sinks into complete idiocy. Avoiding the society of man, he seeks the dark forest, or some solitary ruin, and there for days together indulges his pernicious habit. While under the influence of coca (and the same is true of the hasheesh eater) his excited fancy riots in the strangest visions of ideal beauty, and is next haunted by dreadful apparitions." Our traveler, Tschudi, was never able to find out how the miserable devotee finally awakens

Effects of excessive use.

to sober sense again. Probably not till the exhaustion of his supply of the leaves compels him to return to the ordinary affairs of life once more, either to procure means for renewed indulgence, or to recover from the effects of his excess, as the drunkard recovers from his debauch.

No history informs us when, or how this plant became known to the Peruvians, or who first discovered the virtues possessed by its leaves. Pizarro found it playing an important part in the religious ceremonies of the Incas; being used on all public occasions, either for fumigation or as an offering to their deities. The priests chewed coca while performing their rites, and the favor of the invisible powers was believed to be obtained only by a present of these valuable leaves. No work, began without coca, could come to a happy termination; and divine honors were paid to the shrub itself.

Superstitions of the Peruvians in regard to coca.

The Spaniards at first endeavored by every means in their power to abolish the use of coca; hoping thus to break up the superstitions connected with it in the minds of the natives. But it was found too thoroughly interwoven with all their national characteristics and usages, to be eradicated by laws or penalties. The Indians, accustomed to its use all their lives, could not, or would not work without it; and as the miners and planters required their aid in all departments of labor, the point of contention was at length given up; and the Indian is now at liberty to use all the coca he can afford.

Prohibition of its use by the Spaniards.

"When the remarkable properties of this plant are considered," says Hartwig, "it is indeed astonishing that it has been so long unnoticed. Were it concealed in the interior of Africa, or where it was difficult to procure, this fact could be more easily accounted for; but hundreds of vessels annually frequent the harbors of Peru and Bolivia, where it may be obtained in large quantities. And yet it has only been rarely, and in small amounts, imported into Europe, and is almost or quite unknown in the United States."

When it becomes known, however, it is sure to constitute a valuable article of commerce; perhaps as much so as tobacco and opium.

CHAPTER XXII.

MISCELLANEOUS ARTICLES.

SPONGE.

SPONGE is a very porous, compressible substance, found adhering to rocks, shells and other surfaces, particularly in the Mediterranean sea, among the islands of the Archipelago. Where found. Good sponges are also found in the Red sea, on the Florida coast, and that of the Bahama islands. Those from the Greek islands, however, are considered the finest sponges of commerce.

Sponge was formerly supposed to be a *vegetable* production, but is now classed among the lowest orders of the animal kingdom, as it yields, when analyzed, the same principles as animal substances in general, though never exhibiting the least sign of sensation. It is light and soft, usually containing embedded fragments of mineral matter and small shells, especially in those of coarse texture, and large size. It is traversed by innumerable pores, the microscope showing the whole net-work of the sponge to be composed of fine tubes. If examined while

Nature of sponge.

in the water, currents are seen passing out of the larger openings, the water probably entering through the smaller pores, thus giving rise to an obscure motion or circulation. As an animal, it lives on the water and what the water holds in solution, and therefore it is probably necessary that water should be constantly passing through it. The *bottle sponge* curiously exhibits this motion. It is so called from its shape, being much like that of a bottle. Its absorbing pores are all on the outside, and its vents, or larger openings within; so that there is all the time a strong current pouring from the mouth of the bottle.

Circulation in the sponge.

Bottle sponge.

In some of the Greek islands the inhabitants make it a business to obtain sponges by diving, having been trained to it from their infancy. Other methods are sometimes resorted to, such as spearing or grappling, but they injure the sponges, which adhere firmly to the bottom, and are not detached without difficulty. When first taken from the water they are covered with a slippery gelatinous substance, which is removed by washing. They are placed in heaps under piles of stones, which press them closely together, so that they become hard and flat when dry. The mineral particles are taken out by beating the sponge till they are reduced to powder, which passes off in the water when washed. After this process is finished, the sponge is ready for use, or market. It is a very curious fact that after re-

Preparation of the sponge.

moving impurities, the sponge weighs more than when first taken from the water.

Sponges serve a great variety of useful purposes both in the arts and medicine, and contribute in many well-known ways to cleanliness and comfort. They are of very unequal value, the texture of some being fine and soft, while others are coarse and rough. Smyrna is the great market for sponges.

Uses of the sponge.

The latest use to which sponge has been applied is said to be that of making it into cloth. A Frenchman has lately obtained a patent for this manufacture in this country. The sponge employed is chiefly that found upon the rocks of the Bahama islands, and the coast of Florida, which is an excellent quality, and inexhaustible in quantity. This sponge when torn from the rocks to which it adheres, appears at first as a heavy black looking mass, having a strong and offensive odor. In order to cleanse and purify it, the sponge is buried in the earth for some weeks, at the end of which all the organic matter will be decomposed, only the fibrous tissue remaining. In this state it is liable to become hard and unfit for the manufacturing process. To obviate this difficulty, the sponge is immersed in water containing from ten to twenty per cent. of glycerine, and then squeezed dry; after which it will be entirely soft and elastic. It is then cut into small pieces, subjected to a carding process, and afterwards felted. Only certain qualities of sponge are capable of being spun into yarn for weaving. One of them is

Sponge for manufacture.

the kind known as "*chipoul*," which has comparatively a long fibre. The felted sponge may be used for hat bodies, carpets, etc.; the sponge cloth for clothing is made in the same manner as shoddy. Sponge may be used in textile fabrics, either with or without the admixture of other fibres, such as wool, hair, etc. Sponge is employed of late as a material for stuffing furniture, mattresses, cushions, etc. The surgeon, physician and chemist, also find innumerable uses for this valuable article.

Sponge felt, and cloth.

GUANO.

This substance is found in vast quantities on certain small islands off the coast of Peru and Bolivia, and also on some parts of the shore or main-land; and no doubt it exists in many other places which have been for ages the resort of sea-fowls. It is an accumulation of the excrement of these birds, and is considered very valuable as a fertilizer for soils. It has been known to commerce but a few years. Guano is the Peruvian term for *manure*, and it has long been used for this purpose by the natives. It is of a powdery consistence, of a dull red or dirty white color, a greasy feeling, and a strong disagreeable odor. It is now brought by ship-loads, and used extensively for fertilizing. The principal deposits are upon the Chincha and Lobos Islands, though it is found in many others. The supply at the Chinchas, whence it is chiefly im-

Nature and use of guano.

ported to the United States, cannot be exhausted for a long time.

Humboldt was the first, or one of the first by whom this substance was introduced to notice in Europe; though it had been discovered and described by earlier travelers, some of whom considered it a peculiar mineral or earth. But its real nature was soon determined. The prodigious swarms of sea-birds which have frequented these islands and shores for ages, have produced these enormous accumulations. Many of the birds only visit the island to lay their eggs, which they deposit in hollows scooped out of the guano. Their numbers are incalculable. The localities where it most abounds are comparatively rainless, and the masses increase with a rapidity of which we can form little idea.

Formation and composition of guano.

The substance is very valuable for enriching land, and has been employed for that purpose in the regions where it is found from the time of the Incas, and no one knows how long before. It contains ammonia, phosphate of lime and other principles; but the salts of ammonia, which predominate, give it its principal value.

ICE.

The trade in *ice* has within a few years become so extensive that this product of cold climates is now very generally distributed in those latitudes where it is never formed; carrying with it an unspeakable amount of comfort and refreshment. The sale of

Ice trade.

ice and snow preserved in the caverns of Vesuvius and the more elevated parts of Etna, has long been a branch of trade at Naples, Catania and the neighboring towns; but the foreign commerce in ice originated in New England, whence the greatest proportion of it is still derived.

Its commencement.

The ice business was commenced in 1805 by Frederic Tudor of Boston. He loaded a vessel from a pond in Saugus, and sent it to the island of Martinique. The first shipment of ice to the East Indies was in 1833, for Calcutta, and it has since been sent to almost every foreign port where the climate does not allow of its production.

Method of cutting and storing ice.

After the ice upon numerous fresh ponds and rivers, especially in the neighborhood of Boston, has been formed of sufficient thickness, it is cut into blocks of uniform size, usually about twenty-two inches square, by an instrument called an ice-cutter constructed with a series of cutting chisels, one succeeding the other and deepening the groove. This is drawn by a horse, and cuts about two inches deep at each passage. When the parallel grooves have been made in one direction, others at right angles with them are cut in the same manner. Wedges are introduced into the grooves, and thus the ice is split into square blocks, which are piled in ice-houses on the shore to await shipment.

It is placed in regular courses, every block exactly covering the one below it. When a compart-

ment has been filled, it is immediately covered with wood shavings or sawdust. The receiving doors are fitted up to prevent waste till the ice is sent abroad or consumed at home. Shipments of ice are principally made from Boston.

A method of producing ice in any climate by artificial means, is reported as a very late invention. Whether it proves a successful one, time must determine.

HOPS.

The *hop* is a perennial-rooted plant, of which there are several varieties. It has an annual twining stem, which, when supported on poles or trees, will reach the hight of twenty feet or more. It is a native of Britain and most European countries, where it is cultivated, as well as in our own. The flowers, when dried, are used largely in the manufacture of malt liquors. They are collected in the autumn, carefully dried and packed in bags ready for market. They will keep for several years, if well cured. Hops have a very bitter principle, which is thought to preserve and improve the flavor of beer. The finest qualities are used in brewing ales, the more common for porter, etc. Hops are used also in home-made beer and yeast; also in medicine, for the sedative properties they contain.

Production and use of hops.

The use of hops in the manufacture of ale and beer seems to have been a German invention. They were used in the breweries of the Netherlands in the beginning of the fourteenth century,

but were not introduced into England till the sixteenth, or two hundred years later. In 1530 Henry VIII. enjoined upon the brewers of his kingdom not to put hops into their ale. But plantations for their culture were formed, notwithstanding, and they were soon in general use. They are thought to render ale more palatable, by giving it an agreeable bitter flavor, and at the same time make it keep longer without injury.

HAY.

Any kind of grass cut and dried for the food of cattle or horses, is called *hay*. Its culture for commercial purposes is confined chiefly to the Eastern, Middle and Western States in this country, from which the southern market and others are mainly supplied. It is sent in the form of pressed packages or bales.

Hay.

GRASS-CLOTH.

There are several plants which produce fibrous materials capable of being woven into cloth without the process of spinning, as in flax and cotton. One of these, the *China grass-cloth plant*, (otherwise named the Rhee of Assam) is perhaps the most valuable, and produces the strongest and most delicate fibre, which is woven into articles of clothing, delightfully cool for warm climates, and into many other convenient forms for domestic or commercial purposes. It has been introduced successfully into some of the West

Grass-cloth.

India islands, where it thrives admirably. In France it has attracted much interest, since a new method of preparing the grass for use has been adopted. A hot solution of carbonate of soda applied to it, makes it assume to a great degree the softness and lustre of silk; and, in fact, it is employed considerably in the manufacture of certain kinds of French silk.

COMMERCIAL FIBRES.

There are many other plants besides those already mentioned which produce fibres fit for various uses, and occupy a higher or lower rank among commercial articles. A few will be named among our miscellaneous subjects. The Lily tribe furnishes several species which afford fibres of great strength; such as the *Yuccas* of our Southern States, which flourish upon the poorest soils from the Potomac to Texas, and will yield filaments from six inches to two feet in length. The leaves of the common *pine-apple*, with whose delicious fruit every one is familiar, furnish fibres from which very fine muslin has been manufactured. Different plants producing fibres.

The *Agaves*, growing in Mexico and Central America, with their pulpy leaves varying from one to twenty feet in length, have fibres which are obtained by simple scraping, and are of remarkable strength. The well known and valuable *Sisal hemp* is a product of these plants. Several species of them have been successfully introduced into the United States.

The bales of the Sisal hemp, which come from the vicinity of Merida, in Yucatan, contain, however, fibres of different materials, though sold under this general name.

The *Banana tribe* also furnishes, from its gigantic leaves, valuable fibres for bagging, cordage, mats, etc. The *Manilla hemp* exported in such large quantities from the Phillippine islands, is obtained from plants of this order. It resembles the Sisal hemp very closely, and it is thought by many that they are almost equally valuable.

The *Sun hemp*, and the varieties of *Jute* are, like the Manilla hemp, imported from the East Indies. Sun hemp is the prepared fibre of the bark of a well known Indian plant, and is universally employed over nearly the whole of Southern Asia as a material for cordage, especially for bale ropes.

The fibres known as *Jute*, are derived from the bark of a tree which is of the Linden family. It is cleansed by soaking in water and subsequent scraping. It resembles the Sun hemp in many respects, but is finer and of less strength. The *gunny-cloth*, of which vast quantities are annually imported into the United States, is often woven with the warp of Sun hemp, and the filling, or woof, of jute. Gunny is imported both in the cloth, and also made up into bags called *gunny-bags*. It forms envelopes likewise for other articles sent from India; saltpetre, Java coffee, etc. Owing to the cheapness of gunny-cloth, the bags are rarely used more than once be-

Gunny-cloth and bags.

fore they fall into the hands of the paper-makers. The paper made from them is of the cheaper and poorer qualities, as it is impossible to bleach the fibres sufficiently to render them serviceable for white paper.

The true hemp and flax are not cultivated in the East Indies to any great extent for the fibres, but mainly for the seed, from which a valuable oil is obtained.

CORDAGE.

The name of *Cordage* is given to all lines larger and stronger than those used for ordinary packing purposes. It embraces all the sorts used in rigging vessels, from the cable and hawser down to the whip-cord and fishing-line.

The manufacture of cordage is a very important business, upon which many departments of commerce depend; and it is carried on more or less in every country on the globe. Cables, ropes, and cords, are mostly made of hemp, spun into what is called rope-yarn. This is doubled and twisted together in many or few strands, according to the size required.

Cables, ropes, and cords.

Rope yarn is spun upon a level, covered way, called a *rope-walk*. The spinner throws a wisp of the prepared hemp around his body, and from the two ends coming from either side, draws out a coarse thread, walking backward and twisting as he goes to the end of the walk. This length being twisted and reeled up, he draws out another in the

same way. From this yarn many times doubled, the largest ropes are made.

The most singular vegetable fibre of the East Indies, convertible into cordage, is the product of the leaf of the sago palm. It is called Ejoa, and resembles black horse-hair. Each tree has six leaves in a year, and each leaf yields about ten ounces of the fibre. Some of the finest trees, however, produce a full pound to each leaf. These fibres grow from the base of the foot-stalk of the leaves, and completely embrace the trunk of the tree where the leaves spring forth; which, in the palm, is always at the summit of the trunk. Both fibres and leaves can be removed without injuring the tree. Cables are made from this singular material.

Ropes of sago palm fibres.

The cordage known as *Coir*, is produced from the short, woody, husky fibres of the outer envelope of the *cocoa-nut*. They are prepared by soaking in water for a long time, or until they become soft; sometimes for six months or more. The husks are dried and beaten, when the woody part falls out like sawdust, leaving only the fibrous portion. The cordage made from it thus prepared, is said to be the finest and best that can be produced from any vegetable material.

Coir.

MATS AND MATTING.

Mats are composed of a great variety of substances according to the use they are to serve. Flags, reeds, bark, hemp, ratans, bamboo and other fibres

are used for this purpose. The coarser textures are employed in packing goods and furniture, enveloping boxes and bales of merchandise, or for covering the floors of passages, vestibules, churches or offices. The finer are used for nicer purposes. Some are very rich and handsome. Matting woven of rushes, either plain or ornamented, makes a very cool and delightful covering for floors in hot climates, or for warm weather in colder ones.

Materials of mats.

The peasants of Russia manufacture immense quantities of mats from hemp and from the bark of the linden tree. In Spain and Portugal, *reed* mats are made with much skill. *Rush* floor mats, and *bamboo* and *ratan* table mats of a superior quality, are brought from China. The mats of the Japanese are soft and elastic, being made of a peculiar species of rush cultivated for the purpose, and serve both for carpets and beds. The rude tribes inhabiting Africa and other barbarous countries are skilled in this manufacture, which is very ancient; doubtless it was the first kind of woven fabric ever fabricated by man.

Where manufactured.

The Russian mats of linden bark are called *bast* mats, and are of more commercial importance than any other. The demand for them, both in home and foreign use, is immense. They are principally produced in the provinces of Viatka, Kostroma and some others, and so great is the consumption of the linden bark (which involves the destruction of the tree) that fears have been entertained of its complete extermination.

Bast mats.

In the months of May and June, when the bark is easily detached from the stem, the villages are almost deserted; the whole population being then in the woods employed in stripping the linden trees. This bark or bast, is also used to some extent for hats.

On the coast of Guinea in the west of Africa, pieces of fine mat, about a yard in length, of uniform texture and nice workmanship, have been held in very high estimation both on account of their utility and the great labor and care bestowed on their preparation. Mats of sheep-skin cured with the wool outside, are among the most useful and agreeable of these articles.

BROOMS, BRUSHES, ETC.

Brooms are made of different materials in different countries. In some parts of Europe, particularly in Scotland, they are constructed of birch, heath, or of the *broom plant*, whence these useful articles derived their general name. In this country, the broom in most common use, is made from the *broom-corn*, a plant cultivated for the purpose. The top of the plant bearing the seed, is the part used for brooms. Many places in New England produce an immense number of brooms annually, which are sent to various parts of the world, being superior to most others for lightness and convenience. They are adapted by their size and shape to various uses.

Materials of brooms.

Brushes are made of small bundles of bristles or

hairs set with glue into a wooden stock, pierced with holes to receive them. Small brushes have the bristles doubled and brought through by means of a wire which secures them, after which they are cut even. Hair and clothes brushes are made in this way. Tooth and nail brushes have handles of bone, and are more delicately finished. Brushes are made in a vast variety of shapes for innumerable uses; and their universal employment gives them importance as an article of commerce. Hemp and other fibres are sometimes used for the cheaper kinds.

Brushes.

CARDS.

Cards are made of leather, through which bent wire is inserted to form the teeth. The wire is of different fineness, according to the use for which the cards are designed. They are employed in many manufactures, and also for combing and dressing the hair of animals. The making of cards is in itself an important branch of business. It is done by machinery which operates with great precision and rapidity.

Cards and card-making.

The common hand cards, which were formerly indispensable to every family in preparing wool and cotton for the loom, are entirely superseded by the complicated, but exquisitely perfect machinery, which now produces fabrics of such amazing variety, abundance and cheapness.

POT AND PEARL ASHES, ETC.

In some countries where wood is abundant, as in certain portions of the United States, Canada, Russia, etc., it is burned exclusively for its ashes. These are collected, placed in large tubs, called "leach tubs," and water poured upon them. Soaking through the ashes, it dissolves out the alkaline matters which they contain, as well as other soluble substances. This liquor which drains through, is called *ley*, and when it is evaporated to dryness, leaves a mass behind which is the *potash* of commerce, and is sold in immense quantities under the names of "pot and pearl ashes." In chemistry it is known as *carbonate of potash.*

Pot and pearl ashes.

Saleratus is a kind of purified potash. It was formerly much used in cookery, but *soda* has in a great measure taken its place. (The latter is obtained chemically from common salt.)

When potash is calcined in a reverberatory furnace, it assumes the form of lumpy granules with a whitish pearly lustre, whence it is called *pearl ash.*

The ashes of those plants which grow at a distance from the sea are most employed in the manufacture of potash. It is made most abundantly in this country, Russia and Poland, where vast forests furnish an inexhaustible supply of ashes. Potash is of great value in many of the arts, in chemistry and in medicine.

Barilla is also the name of an alkaline substance (carbonate of soda) which is found native in Hun-

gary, Egypt and other countries. It is extensively used in bleaching, soap and glass-making. The barilla of commerce consists of the ashes of several marine and other plants growing on the sea-shore. The best is prepared upon the eastern shores of Spain. The Saracens, who introduced the manufacture of barilla in Europe, called the plants employed in its production, *kali*, which with the Arabic article *al* prefixed, has given us the modern term *alkali*.

Barilla and kelp.

Kelp is a less pure alkali, formed by the burning of sea-weed.

Since the manufacture of artificial soda from common salt has been established, barilla is of much less importance as an article of commerce than formerly.

TOYS.

The trade in children's toys is a very extensive one. All the cheaper class are of foreign manufacture, especially the little wooden penny articles, which come mostly from Germany. They give employment to thousands of men, women and children. The cost of the pine from which they are cut being next to nothing, and the labor almost as little, they of course, sell for a very low price. But small and cheap as they are, they go through many hands before they are ready for market; the modern principle of division of labor being fully understood and practiced in the old pine forests whence these toys are derived.

Wooden penny toys.

They are collected at the great toy capital of Sonneburg, to be sent to Rotterdam, and thence by steam to England and other foreign countries.

Sonneberg is a town on the south-eastern border of the great forest of Thuringia, which has a population of only a few thousands, the greater part of whom are employed in the toy trade. The principal toy merchants provide themselves with goods from the makers resident in the town and its vicinity. These again are furnished by the neighboring villagers with the requisite roughly prepared articles in wood, which are fitted up, carved and painted by the more experienced and skilled workmen of the town. Every year an enormous quantity of these light articles, made only for the purpose of amusing children, are exported to almost every part of the world.

Some of the noted manufactories of toys employ only first-rate artisans; and it is interesting to notice the many admirable specimens which these uneducated artists produce. Men of distinguished genius in sculpture and painting have arisen from this class.

The more expensive and highly finished toys also come from Germany or the adjacent countries; the old town of Nuremberg maintaining a monopoly of metal work in this business. Tin toy railroads, steam vessels, omnibuses, etc., come from Biberach in Wirtemberg. Military toys from Hesse Cassel; interiors of shops, stables, drawing-rooms, etc., with their appropriate furniture, are produced in various Prussian districts. Many of these pretty

little delicate articles are made by *prisoners* while serving out their term of confinement. The magic lanterns, magnetic toys, conjuring tricks, model printing presses with types, the perfect model ship, (which is to the boy what the doll is to the girl,) with a host of other metallic toys, are produced at Nuremberg.

Some of the German and Prussian princes have established schools in their dominions to give an art education to the children engaged in the manufacture of toys; and the result is that some of the most beautiful models of animals, etc., in papier-maché come from those thus instructed. Indeed, many of them are too elegant for playthings, and are more properly included among mantel ornaments.

Toys in papier-maché.

The most natural and beautiful *dolls* in the world are made in England. London is the principal seat of the manufacture. The making of the *eyes* alone is a large and profitable business; and the heads are covered with real hair. The hideous *Dutch dolls*, do not really come from Holland, but from the Tyrol. They are called Dutch dolls because Holland is the country from which they are usually shipped.

Dolls.

CHAPTER XXIII.

MEANS AND FACILITIES FOR THE PROSECUTION OF COMMERCE.

COMMERCE is the exchange of merchandise between different places, countries, or communities. The word is at present applied to such exchanges when on a large scale; while similar operations to a less extent, or confined within narrower limits, are more appropriately designated by the term trade or traffic.

It is then the work of commerce to distribute the productions of different climates and people over the earth, so that all may share, enjoy or profit by them. To do this, many agencies are required, and consequently she presses into her service every possible facility. She must have her appropriate *vessels* on every ocean, sea, river and canal; her *railroads*, stretching in unbroken lines across continents, or laid in a net-work over narrower sections of countries; her *caravans* across desert or dangerous regions; her *mail* or *postal system*, reaching the most obscure hamlet on the civilized globe; her *telegraph* lines, spanning hemispheres, and linking land to land beneath the intervening oceans. She requires *mints* for the coinage of her money,

and *banks* to facilitate her business operations at home and abroad. She builds *docks* and *wharves*, *breakwaters* and *light-houses* for the protection of water-craft; and institutes *custom-houses*, *exchanges*, *expresses* and many other ways and means to accomplish her vast concerns on land.

We can only glance briefly at the most important of these facilities for prosecuting commerce, and give a concise account of some of the most common among the innumerable transactions of trade. Methods and means of conveyance then, being the first need of commerce, may be conveniently described under the division of Land and Water transportation.

SECTION I.—LAND CONVEYANCE.

BEASTS OF BURDEN.

In ancient times the sole modes of conveyance were by beasts of burden. The elephant, the camel, the horse, ass and mule were relied upon to carry packages of goods from one great mart to another. And finding greater safety in numbers, against lawless robber bands or wild beasts, men early learned to form themselves into companies for the more secure transport of their merchandise. Thus what are called *caravans* are of very ancient date. Allusion to one of these is probably made in the Bible, where Joseph is sold by his brethren to a company of "Midianites, mer-

Caravans.

chantmen, who with their camels were bearing spicery, balm, and myrrh down to Eygpt."

In eastern countries caravans are still in use, especially where the sandy and desert condition of the soil, and the deficiency of good highways, render traveling alone both difficult and dangerous. Sometimes they are composed of immense numbers of men and animals. In Mohammedan countries the pilgrims who annually visit the tomb of the Prophet in Mecca generally join these companies; so that the movement of a caravan is almost like that of a great army; and as they are usually public concerns, and regulated by government, they are under a sort of military discipline, with appointed leaders. The places where these caravans stop for rest and shelter are called *caravanserais*. The traveler must take with him such supplies as are necessary for himself and his beasts, for nothing of the sort is provided at these stations. Rest, shelter, and water, are all they furnish.

Caravanserais.

The commercial intercourse between Eastern and African nations has been carried on in this way from the remotest period. The two principal caravans that now visit Mecca annually, start respectively from Cairo and Damascus; and almost every one, merchants, pilgrims and all, carry some article of sale or barter to the great fair which is held in Mecca, during this influx of travelers and strangers. Traders from Morocco bring the red fez or bonnet, and woolen cloaks; —the European Turks carry shoes, slippers, em-

Great fair in Mecca.

broideries, sweetmeats, hardware, amber, etc.;—those from Turkey in Asia, carpets, silk goods and angora shawls;—the Persians, cashmere shawls and large silk handkerchiefs;—the Afghans, tooth brushes of peculiar construction, beads, coarse shawls, etc.;—others bring tubes for Persians pipes, sandals and leather work. In fact, there is no end to the quantity or variety of these Oriental goods annually brought by caravan to the great fair in Mecca; where the devotees and merchants buy and sell while they worship at the shrine of Mohammed.

But the caravan journey across the mighty Desert of Sahara is far more extensive, difficult and dangerous. It tasks the endurance not only of the hardiest and boldest travelers, but of the Bedouins themselves, the natives of the region, and of their much enduring camels. It is at the peril of one's life to lose sight of the caravan to which he belongs. The atmosphere creates delusive appearances that may lead him astray. Much as he may suffer, longing for some precious water-spring where he can allay his feverish thirst, he must not venture upon the search; and even though he thinks he certainly perceives the clustering palms which indicate its presence at only a little distance, he must plod on with the long train of camels till he reaches the oasis lying upon his route; a station of refreshment and rest preparatory to the next stage of sand, simoon, and fervid heat.

Sahara.

But for the camel the desert would have remained impassable and unknown. No wonder the Bedouin

ranks it, as he does his date-palm, among the most precious gifts of Allah. Other animals are adapted to the forest, the water, or the mountains. The camel is made to be the carrier, the companion, the guide and servant of man in the *desert.* The structure of his foot adapts him to the loose and sliding sand; being provided with a broad elastic sole which treads securely and lightly over the unstable soil, when he would sink or slip upon smooth or muddy ground. He can support hunger longer than almost any other animal, and is satisfied with the meanest food. He can subsist without drinking for many days, having a structure of the stomach which distinguishes him from all other quadrupeds, its pouch-like cavities forming a natural reservoir which enables him to meet the most trying exigencies of the desert journey—protracted thirst. He is indeed the "ship of the desert," provided with water for his voyage. The hump upon his back, too, is a store of fat, upon which he can draw by internal absorption, should food quite fail, or be very scarce, as is almost always the case while traveling in the desert. But there is a limit to endurance, and even this much abused creature frequently succumbs to the dreadful privations of a desert journey; as the bleached skeletons along the track of the caravan too often testify.

The camel and dromedary.

The Bactrian camel has a double hump upon its back; the dromedary or Arabian camel but one. The latter is the swiftest and most docile; but both are used as the commonest beasts of burden in

Turkestan, China, the East Indies, Syria, Egypt, Arabia, Persia, Barbary, etc.

Each dromedary (or camel) is loaded for the caravan according to its strength, with from six hundred to a thousand pounds. If the burden is excessive, the sagacious beast, which suffers no overloading, will not rise or stir, until it is lightened. Merchandise of every description is thus transported, as with slow and measured pace the caravan proceeds at the rate of ten or twelve leagues a day, winding like a snake in long array through the desert. It often requires many weeks to complete the journey. The load.

Some attempts have been made to introduce the camel as a beast of burden into our own country; the vast plains of the South and West, where neither highways nor railways have yet penetrated, were thought adapted to this mode of land conveyance better than any other at present available. The result of the experiment, however, has not been particularly encouraging.

The *Elephant* is also used to transport merchandise, but to much less extent than the camel, and not over desert tracts of country. The *horse*, the *ass*, the *mule*, the *llama*, are still employed as pack animals in various countries. In many parts of Europe, especially Spain and other mountainous regions, trains of mules or pack-horses, still convey goods from one place to another. Mules are hardier, as well as more sure-footed than horses, and are, therefore, preferred for this service. In South America they are invaluable in Pack animals.

crossing the Andes. The *Llama* was once used a great deal in this way; and in the interior and mountainous sections, is still thus employed to a considerable extent, though the mule has now taken its place generally. In the *Atacama* of Peru, the only great tropical desert of America (a long narrow strip of land lying between the Pacific Ocean and the Andes), the mule is indispensable. He is truly the "ship" of this desert, as the camel is that of Sahara; and the commerce of the region would cease but for his powers of endurance.

Reindeer and dog of cold regions.

In those high latitudes where ice and snow prevail during so great a portion of the year, the dependence of the scanty and scarcely civilized population, is, and perhaps always must be, upon the *reindeer* and the *dog* for the transportation of the few articles of foreign supply which they require in exchange for their furs, skins and oil.

ROADS OR HIGHWAYS.

Highways.

The *highway* or common road, adapted to wheeled vehicles, is an immense improvement upon the trail of the caravan, the bridle-path of the horse, ass or mule, and the sledge track of the dog and reindeer. Here, wagons drawn by horses, mules or oxen, can transport goods from one point to another in regions of country not yet traversed by the iron rail and steam-engine, with far more safety and expedition than when bound upon the backs of the strongest animals. Some of these roads are constructed and kept in repair by private

enterprise, a toll or fare being demanded of those who use them. These are called *pikes* or *turnpikes*. Others are made at public cost and are free to all.

Military roads have been constructed both in ancient and modern times for the passage of great armies through difficult and even unexplored regions of country. These have subsequently served the interests of peaceful commerce, by opening direct and easy communication between nations or communities, once strangers or enemies to each other.

THE RAILROAD.

But the *railroad* of the present time, with its powerful steam *locomotives* and its trains of cars, is the principal method of conveying goods as well as passengers from place to place on land, in most civilized countries. The application of steam as a motive power, both on land and water, is one of the grandest achievements of modern science, and has wrought corresponding effects upon the commerce of the world, as well as upon its physical surface. Hills have been leveled, valleys filled up, rivers bridged and mountains tunneled, to lay the iron tracks over which pass, in immeasurable and incalculable quantities, the products of every clime and country, to reach their final destination.

Railroad.

Farther and farther the lines stretch out each successive year, until very soon the continents will be belted with iron roads, (our own taking the lead,) while by their side, mile for mile, extend the wires of the time-

Extension of railroads.

annihilating telegraph; thus bringing all countries into close and friendly relations, and almost instant communication; and tending to unite the human family into one great brotherhood.

EXPRESSES.

No branch of business connected with commerce, is, at the present day, more extensive and important than the *express service*. It is the handmaid of trade, agriculture, and the useful arts; and there is no community so small or obscure as not to be susceptible of advantage from it. It is an enterprise of recent date, and peculiarly American in its origin and characteristics. Although it has become so thoroughly interwoven with the daily business of the country, that it seems to constitute an inseparable part of its necessary arrangements, the express service, properly so-called, does not date much farther back than the origin of American railroads. England had no part in creating it; Europe did nothing to establish such a business; and thirty or forty years ago it was not dreamed of even in this country, where it is now so indispensable.

The express business.

"Prior to that time," says an able writer on the subject, "stage-drivers performed duties similar to those now discharged by *expressmen;* and *baggage-wagons*, carrying merchandise, as well as *baggage*, served instead of freight-trains. With the advent of railroads, the stage-drivers and wagoners, found their occupation gone. The loss of their service, however, greatly incommoded the public, but the

railroad offered no remedy. Years passed, and trade between town and country suffered from this cause. At length, hardly realizing what an improvement he was about to initiate, William F. Harnden, then a conductor upon the Boston and Worcester Railroad, started the express business in 1839. The *idea* was not original with him, but the honor of having been the first to put it in execution, he well deserves. His route was from Boston to New York, and for several years he acted in the capacity of a messenger, often carrying his entire express matter in an ordinary *valise*. Upon his arrival in New York or Boston, he would hasten to deliver the parcels entrusted to him by his customers, who were chiefly book-sellers and brokers."

When and by whom started.

The business rapidly increased and extended in every direction. Routes have multiplied and lengthened, till now they cross each other like the threads of the spider's web, all over the country; to the unspeakable advantage of commerce, and the convenience of the entire population of this and other lands. The express companies transport nearly all the specie and bullion, as well as a considerable portion of the bank notes, bills of exchange, drafts, bonds, and other securities, and the price of exchange between one city and another, depends in some measure upon the express charges for conveyance. Merchandise, also, of nearly every description, is now forwarded from place to place, however distant, by this method.

Increase and extent of the business.

WATER TRANSPORTATION.

The articles of commerce are conveyed on the water by means of vessels of various kinds. *Merchant ships* navigate every sea and ocean, bearing to distant ports the comforts, conveniences, and luxuries of other lands; receiving in exchange commodities which may be as much desired on the opposite side of the globe. Smaller vessels, schooners, sloops, smacks, cutters, barges, tugs, lighters, pilot boats, etc., serve special purposes of their own, besides waiting on the larger, which frequently can not approach the land, on account of their size.

Merchant vessels.

Almost every nation has something peculiar in the style and construction of its vessels. Indeed the advance made by a people in science and civilization, is perhaps nowhere more evident than in its marine architecture, and the management of its sea-going craft. But nations are learning of each other, and the clumsy junk of the Chinaman will soon give place to the swift and graceful steamer. Indeed the spirit of enterprise which that great nation has caught from intercourse with others, will soon develop itself by its adoption of the foremost improvements of the age. The late Chinese embassy to the leading powers of Christian Europe and America, it is to be hoped, will have a vast influence for good upon that mighty and ancient empire.

Improvements in vessels and navigation.

But on the sea as on the land, *steam* is *king;* and

while upon vast rivers and inland lakes the steamboat plies, laden with merchandise, which is to find market, or export, the huge and stately steam-ship is plowing the ocean swiftly and fearlessly, bidding defiance alike to winds and waves, to storms and calms. Steam-vessels.

Since Robert Fulton, of immortal memory, made the first practical application of steam to locomotion in 1807, when amidst the discouragement of friends, and the sneers of enemies, he conducted his ill conditioned little steamboat, the Clermont, from New York to Albany in *thirty-six hours*, what changes have resulted to commerce all over the world! Robert Fulton.

At present the numerous lines of splendid ocean steamers, regularly visiting the principal ports in every part of the earth, transport a large proportion of the world's commerce, with a speed and security which no other method of water conveyance has ever approached. Lines of steamers.

CANALS.

Inland commerce is carried on in some countries to a considerable extent by means of *canals*. Our own country has several, the longest of which is the Erie canal, connecting the Hudson river with the great western lakes. Holland has long been famous on this account, and China is intersected by them to such a degree that many inhabitants live and die upon their boats, never having a habitation upon land from birth till death. Canals.

Canal-boats are generally constructed to suit their particular purpose. They are long and narrow, that they may be able to pass each other without requiring the canal to be of an inconvenient width.

Canal-boats.

They will contain a very large quantity of goods, and yet may be drawn by a single horse with tolerable ease. There is a tow-path on the side of the canal for the horses. It is a very slow mode of conveyance compared with the railway car or steam-boat. Steam has, however, been applied to the canal-boat in some places, but in general it is best adapted to the slow conveyance of heavy merchandise. The railroad has, in a good measure, superseded the canal, and will probably continue to do so more and more widely.

Within a short time a ship canal has been constructed across the isthmus of Suez, uniting the Mediterranean and Red seas. If the most sanguine expectations of its usefulness are realized, it will furnish a short maritime route from Europe to the East, and become a valuable thoroughfare of commerce. It is constantly liable, however, to be obstructed by the moving sands of the neighboring desert regions, and will probably be kept in repair only at great expense to the governments concerned in its prosperity. Another ship canal has been projected across the isthmus of Tehuantepec, uniting the Atlantic and Pacific oceans.

TIMBER RAFTS.

In some countries, where timber is abundant, it is cut in the forests and floated down rivers to the

cities, or other stations, whence it is exported to foreign countries. Immense quantities are thus brought from the hills of Norway. The Rhine river, also, floats enormous rafts of logs from the forests near its source, to the cities of the Netherlands, where they are broken up for sale. The mass is often many hundred feet long, with a proportional width and hight. The logs are firmly fastened together, and many men are required to navigate them. These men have huts built upon the raft, where they live during the passage.

Rafts of timber.

Timber is also transported in a similar way upon the lakes and rivers of this country. In the northern parts of Maine the trees are felled in winter and dragged by oxen to some neighboring stream or river, and rolled upon the ice. When this melts in the spring, the logs float down to the sea. Where the streams are of sufficient width, and free from obstructions, they are fastened together in rafts. On Lake Champlain, rafts of great extent are constructed to convey the timber to market. It is then sawed in mills, and thus prepared for export, or for home consumption. Lumber is one of the most important of all articles of commerce.

Rafts in this country.

MARINER'S COMPASS.

Important aids to navigation and means for the protection of vessels in dangerous localities, have been invented and adopted from time to time; but

nothing has ever approached in value for this purpose to the *Mariner's Compass.*

This great discovery, which has done so much towards the extension of commerce, introduced a new era in the history of navigation. Formerly the mariners scarcely dared venture out of sight of land lest they should lose their way "where all was trackless," and not be able to regain the shore. They crept along the coasts in their small craft, using both sails and oars in favorable weather, but always looked out for some convenient cove or inlet where they could put in for the night, or find a shelter from the storm. By the use of this noble instrument, however, men have ventured boldly forth into every sea and ocean, and pushed their commerce over the wide world.

Importance of the discovery.

Like many other valuable discoveries, the origin of the compass is entirely unknown. But while different writers ascribe it to different persons who lived at different dates, it is probable that it was known in Europe as early as 1180. The first Christian missionaries to China, found the *loadstone* in use in that country, and it is thought by some that it was brought thence into the European countries. Its true history will probably never be written.

Origin unknown.

It is a very simple instrument, composed of a slender piece of magnetized steel called the needle, to which is attached a circular card with numerous divisions marking different directions. The needle is suspended at its center by a pivot, so as to allow it to

turn by the slightest force; and with little variation it always points to the north. This needle and its card are placed in a circular box covered with a glass top, to prevent the needle from being disturbed by the agitation of the air. The compass box is also suspended in such manner that it always retains a horizontal position, notwithstanding the rolling of the ship. By this means the vessel's course is directed, dangers avoided, and distant countries reached.

Needle, card and box.

When the polarity of the needle was first known, it was used by allowing it to float upon a straw on the surface of water. The English first suspended it on the pivot. It is believed that it was first applied to navigation in Europe about the commencement of the 13th century.

Early mode of use.

Columbus and his companions first noticed the variation of the needle from pointing due north on that memorable voyage which resulted in the discovery of a New World in 1492. It was not then understood, and occasioned great alarm among the seamen. Its explanation belongs to the subject of terrestrial magnetism, one of the most fascinating and interesting departments of physics or natural philosophy, which can not here be entered upon. Another irregularity is called the *dip of the needle;* that is, its deviation from a horizontal position, as one goes from the equatorial regions north or south. If north, the north pole of the needle inclines down towards the earth; if south, the south pole; and the farther

Irregularities of the needle.

north or south the greater the deviation. This fact was first observed by an English manufacturer of compasses in 1576.

DOCKS, WHARVES, DIKES, BREAKWATERS, ETC.

Docks are artificial basins or enclosures in harbors for the reception of vessels, where they may be either remodeled or repaired. They are of two kinds, *wet* and *dry*. A *wet dock* is a basin into which a vessel may be hauled where she may be kept afloat at all times of the tide. A *dry dock* is a place where the water can be excluded while the vessel is being built or repaired, by flood-gates, which are open to let in the water and float out the vessel when ready. This dock may become dry by the ebbing of the tide when the gates are left open, or by shutting the gates at low water and pumping out what remains, by the power of men, horses, steam, etc. In a dry dock every part of a vessel can be examined and its defects repaired.

Wet and dry docks.

Slips are places in a dock-yard or on the bank of a river or harbor, having a gradual descent where vessels may be conveniently built and launched.

A *wharf* is a platform or embankment built of timber, stone, earth, etc., with perpendicular sides, on the shore of a harbor, river, canal or the like (sometimes extending into the water some distance) for the convenience of lading and unlading vessels. In this country the spaces between wharves are called docks.

Wharves and wharfage.

Wharfage is the fee paid for landing goods on a wharf, or for shipping them from it.

A *breakwater* is a large dyke or wall of stone built for the purpose of obstructing and breaking the waves of the sea; thereby converting a dangerous anchorage into a safe and commodious harbor for ships of war, merchant, or other vessels. Some of the most extensive are those of Cherbourg in France, Plymouth in England, Delaware, etc., in this country. Breakwaters.

Dikes are embankments of stone, timber, etc., raised upon low lands to prevent their overflow by the waters of the sea, rivers or lakes. Those of Holland are very numerous. The original meaning of the word is a *ditch* or *drain* for carrying off water. It is now generally used in the former sense, meaning a sea-bank or wall. Many low coasts are thus protected from the inroads of the sea. Along the lands of the lower Mississippi similar embankments are termed *levees*. Dikes.

LIGHT-HOUSES AND SEA SIGNALS.

A *light-house* is a tower or building with a powerful light at the top, erected at the entrance of a port, or at some important point on a coast to serve as a guide to mariners at night. Various means are used to produce the light and make it so intense as to be visible at a distance. Modern science has aided greatly in effecting this object, and at the present day these most useful structures are built with a solidity, Light-houses.

and illuminated with a brilliancy never before attained.

Light-houses are of ancient date. The *Colossus of Rhodes*, a celebrated brazen statue more than a hundred feet in hight, which stood at the entrance of the harbor, is believed to have served the purposes of a light-house. It was built about three hundred years before Christ, and was partially destroyed by an earthquake about eighty years after its completion. As late as 672 of our era, the metal of which it was composed, was sold by the Saracens to a Jewish merchant of Edessa, for a great sum of money.

Colossus of Rhodes.

The *Pharos of Alexandria*, built about the same time as the Colossus, was a tower of immense size and hight, on the top of which a fire was kept constantly burning by night, visible to seamen at a distance of forty miles. From this tower the modern light-house is often called a *Pharos*.

Pharos of Alexandria.

Both the Colossus of Rhodes and the Pharos of Alexandria were included by the ancients among the "Seven Wonders of the World."

Among the most noted of modern structures of this kind, is the Eddystone light-house, on the coast of Cornwall, England. It is built upon one of the Eddystone rocks which lie in the English channel, about fourteen miles south-west of Plymouth. These rocks are not much elevated above the sea at low water, and at high tide, or in a

storm, are entirely hidden, forming a very dangerous obstacle to navigation.

It was not till many vessels had been wrecked here that the attempt was made to erect a light-house upon them; an enterprise of peculiar difficulty and danger. But in 1696 a structure was commenced which required four years to complete. The architect was so confident of its strength that he is said to have frequently expressed a desire to be in it during some tremendous storm, that he might witness its effect upon the building. In November 1703, he was superintending some repairs in the light-house, which had stood for three years, when there came on one of the most terrific tempests ever known upon the coast of England. Next morning not a vestige of the light-house remained! It had been swept into the deep with its builder, leaving no trace even of its foundations, upon the fatal rock.

Eddystone light-house.

After the destruction of this first Eddystone light-house, the necessity of another was shown in the renewed casualties which befel shipping upon this dangerous spot; and in 1709, another building was completed, which stood for more than forty years, encountering some very severe storms, when, being constructed of timber, it was accidentally destroyed by fire.

In 1759 the present structure was erected by a celebrated engineer named Smeaton, which has already weathered the storms of more than a century. It is a round tower built of stone, gradually diminishing in circumference from the base up to a cer-

tain hight, like the trunk of an oak, from which the architect states that he derived his idea. No one can estimate the number of lives, nor the amount of property this admirable light-house has been the means of preserving. And many others, placed in perilous points, have also constantly contributed to the protection of seamen and the security of the vessels they navigate from one port to another, and the cargoes they convey.

Other means are also employed to point out sunken rocks or other impediments in the path of the seaman. Floating lights, light-boats, beacons, buoys, signals with the bell, gong, gun, or fog-whistle, warn the mariner in numberless places of hidden dangers beneath, or of others unseen around him.

Great improvements have been made in methods of illumination for light-houses, as well as in the accuracy and efficiency of sea signals.

Many very interesting events have occurred at various dates and places, in connection with light-houses, and other means devised to avoid the perils of the sea. *Bell Rock*, a lonely reef opposite the Firth of Fay, on the east coast of Scotland, twelve or fifteen miles from land, has been celebrated for many centuries as a place of peculiar hazard to vessels, and from its situation it was long found difficult to establish any adequate method of warning to vessels in its vicinity. It derives its name from the fact that the humane monks of a neighboring abbey, devised a floating bell, tolled by the moving waves, and rung with

Bell Rock.

appalling energy the higher the storm rose. But with the decay of the abbey, went also the bell, and accidents were the frequent result. Thrice afterwards private beneficence provided a wooden beacon, which speedily gave way to the winds and waves. About the beginning of the present century, however, Robert Stevenson, after four years of the severest labor, completed a noble structure of stone, which, besides its brilliant and far reaching light, has revived the old tradition of the bell. It is still heard booming amidst the crash of the breakers, being moved by the revolving machinery of the lamps; and furnishes a most valuable signal in foggy weather.

POSTS AND MAILS.

The establishment of *posts*, by which letters and packets may be regularly conveyed from place to place, has been one of the most efficient instruments of civilization, as well as one of the most important adjuncts of commerce, by diffusing intelligence and information, and facilitating business operations between parties at a distance.

The name of *post* is said to be derived from the Latin *positus*, which means *placed*, because horses were anciently placed at certain distances apart, for the purpose of transporting messengers or letters. These messengers, who traveled on horseback were generally in the service of the government. Posts.

The first posts date back to the time of Darius I.

of Persia, B. C. 522, who, we read, caused couriers with saddle-horses to stand ready at different stations, a day's distance apart throughout the empire, in order to receive reports from the provinces without delay.

In some of the Eastern countries *carrier-pigeons* were used in early times to convey information but never to any great extent. A *pigeon post* was established and sustained at great expense for half a century or more by some of the Caliphs of Bagdad and other Mohammedan princes, but at length the birds fell into the hands of enemies and the system was destroyed. It was occasionally revived again by wealthy individuals, as it requires much time and patience to train the birds. The principle acted upon in this system was the attachment of these birds to their home and mate. When young they are made as tame as possible and the mates kept together, as they are naturally inclined to do. They are then sent in an open cage to the place whither they are to carry messages, and treated with great kindness, still being kept constantly together. If now one of these birds is carried away, even to a very distant place, and set at liberty, it will certainly return to its mate. This beautiful instinct is turned to account by fastening a small letter written on the finest and lightest paper to the feathers beneath the wing. In its anxiety to reach home the pigeon will sometimes fly many hundred miles in a day.

Pigeon posts.

It is said that certain merchants in Paris and Amsterdam have sometimes employed carrier-pig-

eons in order that the prices of stocks and merchandise in Paris might be known in advance of the posts at Amsterdam; a service much better, and more speedily accomplished at the present day by the telegraph.

During the late terrible conflict between the French and Prussians, which has just come to an end, the pigeon post was again brought into service. In ancient times the despatch borne by the bird was necessarily short, as the slightest weight was an impediment to its flight. But modern science and skill have remedied this difficulty by applying to it the photographic art. A regular line of post pigeons was established between Tours and Paris during the siege of the latter city, the birds being brought from the capital by balloons. No less than 3500 despatches, of twenty words each, in all 70,000 *words*, could be carried by one of these winged messengers. Those who have examined the microscopic photographs of the Lord's Prayer, or the Ten Commandments, know that though to the naked eye the words appear as mere grains of dust, they are perfectly plain and legible under a good lens. In this manner these despatches were prepared upon the lightest of paper, the whole being of scarcely appreciable weight, and proving no burden at all to the pigeons. At the end of the route the despatches were read with the utmost facility. A page of the London Times has been compressed into the space of less than an inch.

The system revived at the late siege of Paris.

When commerce began to flourish in modern

times, *post coaches* or *stages* were employed, and at the present time, where the railroad is not yet available for the service, letters and other mail matter are thus conveyed; the government forming a contract with the owners of coaches and other public vehicles to this effect. In England a guard accompanies the mail for its protection.

Post or mail coaches.

The first regular post-office was established in England, in 1654, by Cromwell. The office of *Postmaster-General* in England was first conferred by Queen Elizabeth upon Thomas Randolph, a gentleman who had aided essentially in the establishment of the mail system in Great Britain. In this country the first post-office was established by an act of Parliament in 1710. After the Revolution this department came under the control of the new government, and was placed by the Constitution in charge of Congress, with power to establish post-offices and post-roads, and provide for the safe transmission of mail matter all over the country. The entire business is under the particular direction of the Postmaster-General, at Washington. Robbery of the mail is punishable by heavy penalties; but since its transportation by railway, or by steam-vessels, the cases of this crime are comparatively few. Letters which are not claimed are sent to the *Dead Letter office*, at Washington, where they are examined and returned to the owners or writers if they can be found.

Post-offices, etc.

The greatly reduced rates of postage, and the security and rapidity with which mail matter is con-

veyed by steam, on land and water, have increased and extended correspondence all over the globe, as well as furnished a ready method of circulating newspapers, books, and other articles of importance; thus operating to the manifold advantage of commerce, and scattering world-wide intelligence, civilization and refinement, which are sure to create a demand for her innumerable commodities.

Postage.

The word *mail* as applied to our postal system, comes from the French *malle*, a trunk, or a similar word in several other modern languages having the signification of sack, bag, budget, etc. Hence the *contents* of such a bag or sack have come to bear the meaning of the original word.

The word mail.

PNEUMATIC RAILWAY.

Experiments are in progress at the present time to test the practicability of employing atmospheric air as a motive power in place of steam. The elastic properties of air admit of great compression. By the effort to expand after such compression, when made under favorable circumstances, a force is generated, which, if properly applied, may in future become, in certain situations, a substitute for steam. The operation of this principle may be seen in the Pneumatic Railway in the city of New York, a section having just been constructed. Whether it is adapted to great distances, or to popular use, or to subserve the grand interests of commerce, remains to be proved.

TELEGRAPHS.

The word *telegraph* means *writing afar off*, or at a distance; expressing the fact common to all kinds, that what is communicated at one point is received and understood at a distance.

A telegraph then, is an apparatus or a process for communicating intelligence rapidly between distant points. It is done either by means of visible signals representing words or ideas, or by means of words and signs transmitted by electro-magnetism.

The first method, with many variations, alterations, and improvements has long been in use; from the *beacon*, lighted from hill to hill, to convey tidings of victory or disaster, to the more complicated system of modern *signals* by land or sea. The second is of recent date, and is one of the sublimest achievements of modern science.

The *signal telegraph* is one in which preconcerted signals made at one place with an instrument or otherwise, are seen and interpreted at another. This may be done by an apparatus of *arms* and *pointers*, elevated upon a post or mast, which can be moved so as to occupy many different positions. These positions all have specific meanings, which are duly explained in books, similar in design to a dictionary. This *telegraph dictionary* only differs from any other in having a list of *numerals* instead of words under each letter of the alphabet, with the meanings following the numerals. Now the arms of the telegraph being placed in certain positions express particular

Land or indicator telegraph.

numbers; and the observer looks for the number in his dictionary, where he finds the word signified by it. This is the *land* or *indicator telegraph.*

There is another kind used at sea in conveying intelligence from one vessel to another. It is called the *marine telegraph*, and is operated by means of flags. Ships can thus communicate with each other at the distance of several miles. These forms of the signal telegraph are used much less than formerly, especially the land instrument, which has been superseded by the electric telegraph.

Marine telegraph.

ELECTRO-MAGNETIC TELEGRAPH.

For this great invention, the crowning triumph of science and human ingenuity which enables us with the rapidity of thought to communicate with distant points over thousand of miles of intervening land or sea, the world is mainly indebted to an American—Samuel F. B. Morse.

Inventor of the electro-magnetic telegraph.

Electro-magnetism is that species of magnetic force which is developed by the passage of electric currents. It was first discovered and described by Prof. Oersted of Copenhagen in the year 1819. He found that a wire along which an electric current was passing, was rendered magnetic by the current which it transmitted. Numerous experiments were made and various batteries constructed for producing the electrical current in greater intensity. These experiments developed other and interesting facts.

It was seen that if a wire, or many wires together were insulated and wound into a coil called a helix, and connected with a battery, any piece of soft iron or steel would become highly *magnetic* if placed within the coil. The steel would permanently retain its magnetism, while the soft iron would lose it the moment the current ceased. This fact with others of more or less importance suggested the possibility of its being turned to practical account in the telegraph. In 1837 Morse produced his apparatus for transmitting and recording communications.

Electro-magnetism.

The first line was established between Baltimore and Washington a distance of forty miles. This was done in 1844 by an appropriation from Congress to test the invention. The enterprise succeeded perfectly; and since then the wires have been stretching farther and farther over the earth and under the oceans; linking continent to continent, island to island, sea to sea, and will in a very few years no doubt, encircle the entire globe.

First trial and success.

The value of such a system of communication to commerce, to trade, to literature, science, religion, and every other department of human knowledge and effort, is not to be comprehended or conceived!

Some varieties exist in the machinery of electro-telegraphs. Many systems have been contrived in this and other countries to supersede that of Morse. But not one has succeeded in doing so. It is at the present moment employed on more

than nine-tenths of all the existing telegraphic lines. The *printing or House telegraph*, which produces the messages printed on slips of paper, in plain Roman letters, possesses decided advantages over many of the others. The characters employed by the Morse telegraph, are dots and lines.

Printing telegraph.

Many separate telegraphic organizations have been formed in this country, but they are now mostly consolidated into one great company, having its head-quarters in New York city, and its wires thrown out in all directions over the length and breadth of the continent. For the territory now occupied by the lines of the *Western Union Telegraph Company* embraces almost the entire civilized portion of North America. The present number of telegraphing stations (1871) is four thousand, two hundred; its miles of line nearly fifty-six thousand; its gross earnings for the last year (1870) seven and a half millions of dollars!

Western Union telegraph company.

Let us for a moment allow ourselves from this point of its growth and prosperity to look back upon the day of small things of this grand enterprise.

In the year 1842, Samuel F. B. Morse, confident that he had made a valuable discovery, invited a number of his friends to see the experiment of sending messages through a wire, in an upper room of the New York University. A coil of isolated wire was placed in the middle of the room, wound round a cyl-

An experiment.

inder, the mass of which contained some *five miles* of wire between the two projecting ends. Mr. Morse operated at one end, and the recording process was seen by everybody to be simultaneous in its action with the movements of his fingers.

"What do you think of it?" was the question addressed to one of the most intelligent observers of the exhibition, when its perfect success was established.

"A very ingenious contrivance," was the reply; "*but it can never be made practically useful!*"

It was only after much delay and great efforts that a line of poles and wires was constructed along the railroad between Baltimore and Washington, in 1844; and curiously enough, one of the first achievements of this new and strange system, was the causing of the arrest of a criminal who had escaped from Washington by railroad. He was *telegraphed* for to Baltimore. The police officers of that city having received the dispatch, stood at the Baltimore depot on the arrival of the train, and quietly took charge of the culprit as he stepped from the car. It was but the first of many thousand similar offices the telegraph has been called on to perform. Many a rogue has had occasion to regret the discovery of Professor Morse, and many more will doubtless do so.

An early achievement of the system.

But, though like all grand inventions of world-wide advantage, it has had to contend with distrust and prejudice, it has at length taken its proper place at the head of this majestic catalogue; and

the name of its inventor has become one which nations delight to honor, and which is a pride and boast to his countrymen.

It is not often that a great genius survives to witness the complete success of his invention, and its universal appreciation. The honors and rewards of such men have too often come long after they have finished a life of care, perplexity and disappointment, while those of another generation, perhaps, have reaped all the advantages and emoluments.

It has, however, been the privilege of Professor Morse to live to see his work perfected and honorably acknowledged the world over.

While these pages are in press, the venerable man, still unbent by his burden of more than eighty years, has participated in the ceremony of unveiling a statue in bronze, erected to his honor, in Central Park, in the city of New York. It took place on the 10th of June, 1871, and as the whole subject of telegraphy is so intimately and completely identified with the interests and operations of commerce, we insert a few brief particulars of this memorable occasion.

Statue of bronze in Central Park.

"The unveiling of the Morse statue was a great tribute to a great achievement, and a deserved recognition of a great man. Ten thousand persons gathered in the vicinity to witness it, among them some of the most distinguished men of the age. The sentiments of appreciation expressed and applauded, not only did justice to the grandeur of the

theme, but rendered deserved honor to the *Inventor of Telegraphy*, whose hoary hairs were assuredly, in this instance, a crown of glory." One of the speakers gave some account of the value of the invention in time of war. The first practical use of the telegraph in war was during the Austro-Italian conflict, in which the French were the allies of the Italians; and the advantages gained by them were mainly due to the telegraph and railway. In the late Franco-German war, just terminated, every important event, from the declaration of war to the declaration of peace, was announced by the telegraph, and all the combinations and movements of the victorious Germans were directed by the same means. It may, therefore, be truly said that the genius of our great countryman (in an important sense) enabled the victors to accomplish the grand results of the struggle. *Mitrailleuses** and *chassepots*, and *breech-loaders* are dangerous instruments, but the *telegraph* is the most effective weapon of all!"

The telegraph in war.

Professor Morse addressed a few words to the assembly, which was mostly composed of those personally and practically interested in the business of telegraphy. "Friends and children of the Telegraph," he said, "you have chosen to impersonate in my humble effigy, an invention, which, cradled upon the ocean, had its birth in an American ship. It was nursed and cherished not so much from per-

*Guns of recent invention, used in the late war between France and Prussia.

sonal as from patriotic pride. Foreseeing its future, my most powerful stimulus to perseverance through all the perils and trials of its early days, was the conviction that it must become world-wide in its application; and moreover that it would be hailed everywhere as an *American gift* to the nations!" He then narrates the stages of its progress, the obstacles it had to surmount, the discouragement and poverty which protracted the struggle; gratefully naming the men who at that time came forward to aid the weak enterprise with their influence, counsel and money; and of its final triumph at the present moment "when this vast country, from the northern boundaries of Canada to the Gulf of Mexico, and from the shores of the Atlantic to the Pacific, are webbed with telegraphic wires!"

Address of Prof. Morse.

A happy allusion to the first idea of a submarine telegraph, was made in these words of Prof. Morse: "Another grand stride was to be taken before international communication could be established. In October, 1862, the first submarine telegraph cable (to test the possibility) was laid by me one moonlight night, in the harbor of this city, the perfect success of which proved the practicability of the thing. From this result, I ventured to predict the certainty of an Atlantic telegraph. It was then regarded as a visionary dream. But at this crisis another mind was touched with the necessary enthusiasm to undertake so marvellous an enterprise; a mind admirably fitted in every particular, by indomitable

First idea of submarine telegraphy.

energy, perseverance, and foresight. To Cyrus W. Field, more than to any other individual, belongs the honor of carrying to completion this gigantic task. Associating with himself on both sides of the Atlantic, men of his own stamp, who were never daunted by temporary failures and unforeseen accidents, he rested not till the Old and New World were in instantaneous communication!"

The occasion was made still more memorable by the sending from the spot the following dispatch: "Professor Morse sends greeting to the telegraphic fraternity throughout the world; 'Glory to God in the highest, peace on earth and good will to men!'"

A greeting to the world.

The instrument used was the *first* battery employed upon the *first* telegraphic line, that between Washington and Baltimore, which has been preserved as a memento. The first message transmitted, "What hath God wrought?" is in sublime and admirable keeping with the last.

SUBMARINE TELEGRAPHS.

The original *transatlantic telegraph*, laid in 1857, though at first a failure, has been followed by two others, which are in constant and successful operation at the present time. They have been laid also beneath various other bodies of water; so that

Present extent of telegraphic communication.

at this day the communication is complete with the opposite side of the globe, and nations scattered over it in all directions. The "*miracle*," as it was once regarded is achieved, by which we can speak to and

receive a reply in a few seconds of time from our antipodes in China! Well might the honored father of the system exclaim through the wires, "What hath God wrought!"

No doubt the future will witness vast changes and improvements in this art as in others; but it is difficult to conjecture what may be their nature or extent. They will only add to the great sum-total of its advantages to the human race.

CHAPTER XXIV.

COMMON COMMERCIAL TERMS, FORMS, USAGES, AND OPERATIONS.

COMMERCIAL transactions among civilized nations require certain forms to ensure their validity. Certain mercantile terms and usages, common among buyers and sellers everywhere, it is desirable to understand. A few explanations in regard to those which occur most frequently in business matters will here be given.

BOOK-KEEPING.

Book-keeping is the art of recording mercantile transactions in a regular and systematic manner; so that a man may know the state of his affairs and property by an inspection of his books. It so disposes the accounts of business that the true state of every part, and of the whole, can be easily and distinctly shown.

Book-keeping.

Merchants books are kept either by double or single entry; the former method generally used by wholesale dealers, and the latter by retailers. It is called also the *Italian method*, because it was first practiced in Venice, Genoa and other towns in

Italy, where trade was conducted on an extensive scale at a much earlier date than in England, France, or other parts of Europe. Various books are used in the records of business, the accounts being transferred from one to another. Of these the *ledger* is the principal where the several particulars of each account that lie scattered in other books according to their dates, are collected and placed together in such a manner that the opposite parts of each account are set against each other. The left hand page contains the *debt*, marked *Dr.*, and the right the *credit* marked *Cr.* The person who owes anything is the *debtor*, and the one to whom something is owed, is the *creditor*. The *balance* is the overplus or difference between the accounts.

The books.

INSURANCE.

Insurance is a contract by which one party engages, for a stipulated sum, to insure another against a risk to which he is exposed. The party who takes upon himself the risk, is called the *insurer, assurer*, or *underwriter;* the party protected by the insurance is called the *insured*, or *assured;* the sum paid is called the *premium;* and the paper containing the contract of insurance is called the *policy*. Insurance may be effected on almost every kind of property; on life, health, etc.; against accidents by fire, water, or those incurred in traveling. The business in all its departments is of vast magnitude and

Insurance of various kinds.

extent. It is one of those safeguards to which commerce has constant and continual recourse. *Marine insurance* is that by which vessels of every kind, with or without their cargoes, are secured against the dangers of the sea, and is a special branch of the business. The underwriters who attend to this kind of insurance, ascertain as far as possible what the risks are in every voyage, by every species of vessel, and charge rates accordingly.

The business of *life insurance* is already carried on to an immense extent, both in England and this country, and is annually increasing in importance.

BROKERAGE AND BROKERS.

Brokerage is the commission or percentage paid to brokers on the sale or purchase of bills, funds, goods, or property of any kind.

A *broker* is an agent or intermediate person who transacts special business on account of another.

Origin of the name.

The term is supposed to be derived from the Latin *abrocator* or *brocarius*, which both mean a *negotiator*. The old Norman-French word *broggour*, the old English, *brocour*, and the modern French *brocanteur*, have about the same signification. The kind of business indicated by these terms is of considerable antiquity.

The province of a broker is to find buyers and sellers, and to bring them together to make their own bargains, or to transact for them the business of buying or selling. The class is confined chiefly

to large towns and cities; as in small places where only a very limited amount of trading is done, the buyers and sellers usually know each other, and need not be at the expense of employing a third party. But where both are very numerous and strangers to one another, there is a necessity for a distinct class whose office it is to act as a negotiator or agent between them.

A broker's province.

Brokers are divided into different classes dependent upon the kinds of property in which they chiefly deal. A *bill broker* is one who buys and sells notes and bills of exchange. An *exchange broker* buys and sells uncurrent money, and deals in exchanges relating to money between different countries. An *insurance broker* effects insurances on lives or property. A *stock broker* negotiates transactions in the public funds, and deals in stocks of moneyed corporations and other securities. A *real estate broker* buys and sells houses and lands, and obtains loans of money upon mortgage. A *merchandise broker* buys and sells goods. A *ship broker* deals in the purchase and sale of vessels, procuring freight, etc. A *pawnbroker* advances money on various kinds of goods taken in pledge, on condition of being allowed to sell them if the sum advanced is not repaid with interest after a specified time. *Brokers*, simply so called, are often understood to be those who appraise or sell household furniture, etc., held for rent.

Different kinds of brokers.

Brokers, both in money and merchandise, were early known in England, and their dealings regu-

lated by law. The rise of such a class of agents in any department of business, is an indication of its increase and prosperity.

BANKS AND BANKING.

Banks are establishments intended to serve for the safe custody and issue of money, for facilitating its payment by one individual to another, and sometimes for the accommodation of the public with loans.

The first bank of which we have any reliable record was established in Italy, A. D. 808, by the Lombard Jews, of whom many afterwards settled in Lombard street, London, where many bankers still reside. The name is derived from *banco*, a bench, which was usually erected in the market-place for the exchange of money. The English merchants, lacking a safe place to deposit their cash, first used the Mint in the Tower of London, for this purpose.

Origin of banks in England.

But the credit of the mint was destroyed when King Charles I. laid his hands upon the money and appropriated it to his own use in 1640. The traders were thus driven to seek some other place of security for their gold, not daring to keep it in their own possession, as their clerks and apprentices frequently absconded with it. In 1645, therefore, they were induced to lodge it with the goldsmiths of Lombard street, who were provided with strong chests for their own valuable wares; and this became the origin of banks in England.

Banks are commonly divided into two great classes, *banks of deposit* and *banks of issue*. *Banks of deposit* are those designed for the keeping and employment of money deposited with them or entrusted to their care by their customers, or by the public. *Savings banks*, where small sums may be placed on interest, and readily withdrawn, are of this kind. *Banks of issue* are those which besides employing or issuing the money entrusted to them by others, issue money of their own, or notes payable on demand.

Banks of deposit.

A *bank of discount* is one where attention is principally given to the discounting of promissory notes and bills of exchange, and the loaning of money on security. If a note is presented at the proper time, and the payment made, the *paper*, or note, is said to be *honored*. If, for any adequate reason, the payment is refused, the note is said to be *dishonored*.

The convenience of these institutions in facilitating commercial transactions, has caused them to be established in almost all the important places in Europe as well as in this country. The buildings or apartments where banking business is carried on, are also called *banks*. They are often very splendid edifices.

Bankruptcy (or insolvency) means the inability of an individual or corporation to pay debts.

PROMISSORY NOTES.

Promissory notes, or *notes of hand*, as they are often called, are written promises to pay within a

certain time the sums therein mentioned, either to a particular person or to any one who may be the bearer of the note. If the form used in writing the note is such that it may be transferred from one to another, it is called a *negotiable note*. Endorsement is writing the name of some person who must be responsible for its payment upon the back of the note.

Notes of hand.

BILLS OF EXCHANGE.

A bill of exchange or draft, as it is often called, is a written order or request from one person to another desiring him to pay a sum of money therein named to a third person mentioned, on his account. Like a note of hand it must be made payable to *order* or *bearer*, in order to be negotiable or transferable. It was a method originally devised among merchants in different countries for the more ready remittance of money from one to another. By this means at the present day, a man in any part of the civilized world may receive money from any trading country, instead of being obliged to carry from home all over the earth the money he requires. Transactions of this kind are generally managed by persons called *exchange brokers*, who are acquainted with different merchants in various places at home and abroad.

Bills of exchange.

The buildings called *exchanges* are those places in large cities, where merchants, agents, bankers, brokers, and other persons concerned in commerce, meet at certain times to confer on matters of busi-

ness. They are often very fine buildings, erected at great cost. A *bourse* signifies a place for similar purposes.

STOCKS AND PUBLIC DEBT.

The term *stock* is used under several significations, among others it expresses the *capital*, or money invested in business, by individuals or firms; and also that of a banking or other money establishment. The word *stocks*, however, is the general name by which the *public debt* or *debt of a government* is known.

The *public debt* is one contracted by the government of a country. In the United States it is done by an act of Congress authorizing the Secretary of the Treasury, or any other person whom the act may designate, to borrow money and issue certificates for the sum borrowed. The act states the whole sum to be borrowed, the rate of interest, and the time when the principal is to be paid. *Books of subscription* are opened in the large cities, and any person who chooses to lend, subscribes. Each lender receives a certificate that he is a creditor of the United States for the sum by him loaned. These certificates are registered at some national bank. Any one holding or owning one, can sell it and assign his certificate to the purchaser.

Stocks, public debt, etc.

These *stocks*, or portions of the public debt, always have a market value, sometimes above and sometimes below the nominal value. They are the subject of speculation, being bought or sold, with

the expectation of profit. *Stock-jobbing* is a traffic or dealing in stocks. It is often carried on by persons who have little or no property in them, but who hope to realize gain by contracting for, and transferring them.

Stock-jobbing.

The terms *bulls* and *bears* originated in the London stock-exchange, but as they are often heard, it is well to understand what they mean. They refer to persons engaged in the gambling transactions of the stock-exchange. The *bulls* are the buyers, and the *bears* the sellers. The *bears* contract to deliver at a specified *future time* stocks that they do not own; the *bulls* contract to take them. These stocks, however, are never delivered; but there may be a difference in their value between the sale and the time agreed upon for delivery; the losing party has this difference to pay.

Bulls and bears.

Most of the European nations have a public debt, and therefore stocks of the kind above explained are daily bought and sold in the stock market. To give security to these public loans, and thereby strengthen the public credit, modern governments have had recourse to what is called the *funding system.* This provides that on the creation of a public loan, funds shall immediately be formed and secured by law for the payment of the capital itself. This gradual redeeming of the capital is called the *sinking* of the debt, and the fund appropriated for this purpose, the *sinking fund.* These public funds vary in their market value, and many persons make buying and selling

The funds.

shares in them a regular business. This is called *trading in the funds*. The chief part of the public funds in England consists of *annuities* of various kinds; that is, debts on which a stipulated rate of interest is to be paid, unless the principal is redeemed. If that is never required, it is called a *perpetual annuity*. Others consist of annuities for a certain number of years, or for a life, etc. These annuities are distinguished by different titles, according to the rate of interest they pay, or the time and purpose of their creation; and when the government by a new loan contracts an additional debt, bearing a certain fixed interest, it is usual to add the capital thus created to the amount of that part of the public debt which bears the same interest. A fund formed by the *consolidation* of these different annuities, called *consols*, (a contraction of the French *consolides*, or the English *consolidated annuities*), is now the leading English funded government security. This is the stock in which there is most speculation, and hence the value at which it stands generally regulates the rise or fall of other securities.

Consols.

The word *scrip*, often heard, means a certificate of stock, subscribed to a bank or other company. It is also applied to the forms of certificate given in exchange for a loan; as *consol scrip*, etc. When all the installments of the loan are paid, the term is no longer applicable.

A *coupon*, from the French *couper*, to cut, is a certificate of interest due, printed at the bottom of transferable bonds (government, state, railroad, etc.,)

given for a term of years, designed to be cut off and presented for payment when the interest is due. The practice of appending coupons to bonds is now generally adopted, as they facilitate the collection of the interest, which is usually due semi-annually.

THE MINT.

A *mint* is a place where money is coined by the authority of the government. Gold and silver uncoined, or reckoned by weight, in the mass, is called *bullion*. The word coin is from the French, meaning a stamp. In this country the treasury of the United States, buys the metal and causes it to be tried or *assayed* at the mint, and prepared in circular forms of given size and weight. These pieces are subjected to the action of powerful machinery to be *coined* or *stamped*. This money, called *specie*, is paid out by the treasury, and thus gets into circulation. Banks or individuals may have bullion coined at the mint of the United States in any of its branches. Congress establishes the proportion of pure metal and of alloy, and also the weight of the mixture, which shall constitute a piece of money.

Mint and coinage.

Several of the leading commercial nations have recently agreed upon a system of uniformity in regard to their gold coins, in order that they may be of equal value, and used interchangeably.

Counterfeiting is the imitation or copying of coin or bank-notes, with a view to deceive or defraud by passing the false note or coin for the genuine.

The business is often carried on with amazing skill and success.

Legal tender is that money or property which the law prescribes to be offered in payment of debt. It differs in different countries. In the absence of any special agreement, the only payment known to the law is by cash.

PUBLIC REVENUE, TARIFF, CUSTOMS, ETC.

Revenue.

The annual produce of taxes, excise, customs, duties, etc., which a nation collects and receives into its treasury for public use, is called its *revenue;* and this depends largely upon commerce.

Tariff.

Tariff properly signifies at the present day a list or table of goods, with the duties to be paid for the same, either on importation or exportation, whether such duties are imposed by the government of a country, or agreed on by the governments of two countries holding commercial relations with each other. The word is by some supposed to be derived from *Tarifa*, a town in Spain, at the entrance of the Straits of Gibralter, where duties were formerly collected. Others think it comes from the Italian *tariffa*, tariff or tax, and still more remotely, from an Arabic or Persian word meaning *knowledge*, *information* or *explanation*. This sense of the word is now obsolete.

Customs, *imposts* or *duties* are the taxes paid to government upon the merchandise brought into the country or sent out of it. In this country

these vary according to the right given by acts of Congress to demand more or less upon the various articles of commerce. When goods are brought into the country, they are said to be *imported;* when sent away, they are *exported*, and the duties are paid where the merchandise is landed.

Customs or duties.

In every port where vessels come in to unload their cargoes, there is a *Custom-house* at which these duties or customs are collected by officers appointed for the purpose. As soon as a vessel enters the harbor from abroad, it is visited by a custom-house officer, who remains on board till it has reached its moorings. His business is to see that no commodities are sent ashore till all has been properly entered at the custom-house, where the duties are to be paid on the goods. Such houses are also established on the inland frontiers of many countries. Excise is an inland duty or impost laid upon certain articles.

Custom-house.

Smuggling is the introduction of goods into a country in a secret manner without paying the lawful duty upon them. Such goods are called *contraband*, and are often landed on some desolate and solitary coast. To prevent such frauds upon the revenue, great numbers of men are obliged to be constantly on the lookout, and to have at their disposal fast-sailing vessels or cutters, to aid in this service, which is sometimes called the *preventive service*. Vessels suspected of containing contraband goods are pursued by these revenue cutters, and sharp collisions frequently occur be-

Smuggling.

tween the officers of the lawful customs and the smugglers. This illegal traffic, however, has greatly diminished, as the facilities for honest commerce have increased.

BOARD OF TRADE.

A *Board of trade* or *Chamber of commerce*, as it is also called, is a voluntary association of merchants and traders in any city to discuss matters pertaining to commerce, and to promote its interests. The first idea of such an assembly seems to be due to Cromwell, who in 1655 appointed his son Richard with many other distinguished "lords, judges and gentlemen," and about twenty noted merchants of London, and other cities of England to "meet and consider by what means the trade and navigation of the republic might be best promoted." Origin.

Such associations are productive of incalculable benefit to commercial interests in general. They are established in almost all cities of any size.

A FEW COMMERCIAL TERMS AND PHRASES DEFINED.

A *drawback* in commerce is an allowance made to merchants on the re-exportation of certain goods, which in some cases consists of the whole, and in others of a part of the duties which had been paid upon the importation. Drawback.

A *debenture* is a certificate delivered at the custom-house when the exporter of any goods or merchandise has complied with the regulations, in conse-

quence of which he is entitled to a bounty on the exportation. This certificate is signed by the officer of the customs, when the goods are regularly entered and shipped, and the vessel cleared for her intended voyage. A certificate of *clearance* gives her permission to sail.

Debenture.

A *bill of credit* among merchants, is a letter sent by an agent, or other person to a merchant, desiring him to give credit to the bearer for goods or money.

A *bill of entry* is a written account of goods entered at the custom-house, whether *imported* or intended for *exportation.*

A *bill of exchange* is a written order or request from one person to another, desiring the latter to pay to some *third person* a designated sum of money therein named. The one who draws the bill is called the *drawer*, and the person on whom it is drawn, the *drawee.* The person to whom the money is directed to be paid, is called the *payee.* The bill itself, is frequently called a *draft.*

A *bill of lading* is a written account of goods shipped by any person on board of a vessel, signed by the master of the vessel, who acknowledges the receipt of the goods, and promises to deliver them safely at the place directed, dangers of the sea excepted. It is usual for the master to sign two, three or four copies of the bill; one of which he keeps in his possession, one is kept by the shipper, and another is sent to the *consignee*, or the one who is to receive the goods at the end of the voyage.

A *bill of store* is a license granted at the custom house to merchants, to carry such stores and

provisions as are necessary for a voyage, free of duty.

An *invoice* is an account of goods shipped by merchants for their purchasers or agents abroad, in which the peculiar marks, with the value, prices, and other particulars are given. The duties and charges of every kind upon them are recorded, and a book is kept where they are duly copied.

A foreign *agent* or *factor* is a person in some foreign country employed by a merchant to transact business for him; for which he receives a commission of so much per cent. on all the sales effected. He may buy and sell in his own name, and is entrusted with the possession and control of the goods. In these respects he differs from a broker.

Embargo.

An *embargo* is an order from the government prohibiting the departure of ships or merchandise from some, or all of the ports within its dominions. Such detentions generally occur in time of actual war, or when one nation is in a hostile attitude towards another.

QUARANTINE, PRIVATEERING, ETC.

Quarantine.

Quarantine is the period of time during which a vessel, suspected of having contagious or malignant sickness on board, or coming from a port known to be affected by such disease, is forbidden to have any intercourse with the shore or place where she arrives. The term is derived from the Italian word *quaranta*, meaning forty, because forty days was formerly the usual period prescribed

for all vessels under such circumstances. The time of detention varies at the present day according to the exigencies of the case. Vessels are required to carry *bills of health*, which are certificates signed by the Consul or other competent authority, in the place which the ship has left, describing its state of health at the time of clearance. What is called a *clean bill*, imports that at the time of sailing, no infectious disorder was known to exist. A suspected, or as it is more commonly called a *touched bill*, implies that rumors were afloat of contagious disease, but that it had not actually appeared. A *foul bill*, or the absence of *clean bills*, are evidence that the place was infected when the vessel sailed. The duration of the quarantine is regulated by the nature of these documents. They seem to have been first issued in the Mediterranean ports, and are obviously of very great importance.

Bills of health.

The belief that the plague, a dreadful disease which originated in the East, was brought into Europe by ships coming from those ports, was the ground of this institution. The Venetians, who were early distinguished for their commercial and maritime pursuits, were the first who endeavored to guard against its introduction from abroad, by obliging ships and individuals from suspected places to perform quarantine. Regulations for this purpose were probably issued by them for the first time in 1484. They have since been adopted in every other country. In England, their introduction was comparatively late. For

First institution of the system.

though various laws had been previously enacted there, quarantine was not systematically enforced till after the alarm occasioned by the dreadful plague at Marseilles in 1720.

Lazarettos are establishments to facilitate the performance of quarantine, and particularly the purification of goods. When properly fitted up they are provided with lodgings for the crews and passengers, where the sick may be separated from the healthy; and warehouses where the goods may be deposited; all intercourse between the lazaretto and the surrounding country being of course interdicted except by permission of the authorities. The lazarettos of Leghorn, Genoa and Marseilles are the most complete of any in Europe.

Lazarettos.

Privateering is the fitting out in time of war of armed vessels by private individuals or companies for the purpose of plundering the commerce of an enemy. They attack chiefly merchant ships, confiscating both vessel and cargo. A portion of the value of their prizes is paid to the government they belong to, and the remainder divided among the proprietors and managers of the privateering vessels. They must have a commission from their government, and conform to all the rules of war and the laws of nations. When peace is restored, the difficulties that grow out of this system are adjusted in one way or another. The "*Alabama claims*" of which every American child has read or heard, are claims for commercial losses incurred by individuals of this

Privateers and privateering.

country during the late war between the Northern and Southern United States. These claims are made upon the English government on account of its having permitted the fitting out of the *Alabama* as a privateering vessel in one of her harbors (Liverpool) and allowing it to go to sea with a knowledge of its design to plunder the commerce of the United States; England being at the time a neutral and friendly power, and bound to give no aid to the enemies of the United States. The complications thus instituted have been very difficult to settle satisfactorily. But a recent Commission formed of able and honest men from both nations have, at this date (August, 1871,) just completed arrangements for their settlement by *arbitration*, or the decision of other disinterested nations.

We can not perhaps more fitly bring this Manual to a close, than by quoting a few paragraphs just written by one of our own most distinguished scholars and statesmen, Hon. Schuyler Colfax, at the present time Vice-President of the United States, in relation to the *commercial future of our republic*, and the means by which we are to become a great and powerful people. Especially do his words have reference to the vast facilities opened to *commerce* upon our Western or Pacific coast, the unprecedented rapidity of its increase, and its brilliant prospects for the future.

"Within the last twenty years," he says, "the Pacific slope, to which the eyes of the world are now turned, has furnished to commerce over *one thousand millions* of the precious metals, one-tenth of which has come from the wonderful *Comstock Lode* of Nevada! But while ten years ago, out of the forty-three millions exported from California, forty-one millions were in *gold*, she now, out of her fifty-one millions of annual exports, furnishes nine millions in *wheat*, four millions in *wool*, thirty-three millions in gold and silver, and five millions of other products. San Francisco has already made such progress in manufactures that her capital employed in them has reached seventeen millions, the material consumed twenty-three millions, with an annual production of forty-five millions. Already Australia consumes several millions per year of her manufactures, and China and Japan have embarked in the same traffic. Not only are the finest blankets in the world made at her mills, but wool-growing on the Pacific slope has increased with a rapidity unparalleled in the history of our other States, or of the world. In 1855 the yearly product was less than *half a million pounds;* the aggregate is now *twenty millions*, with only a very small proportion of the land suitable for sheep-raising yet in use.

Exports and manufactures of California.

"The few details here given, only present a glimpse of the capacities of the region, and the possibilities of its future.

"One railroad line already connects this interesting portion of our country with the East. Two

others are quickly to follow, striking the coast at San Diego on the south, and Puget sound and the Columbia river on the north, with the intervening region bound together by the interior system of railroads now being rapidly pushed forward, and hastening the good work of development.

Pacific railroads.

"Around the vast ocean which washes its shores, dwell over *one-third of the whole human race!* Excepting the British colony of Australia, ours is the only nation both civilized and maritime, whose possessions border on this great sea.

"In every age of the world's history the trade of Asia has enriched all people who possessed it, even while carried on by the rude methods of the caravan. In turn Nineveh, Palmyra and Alexandria achieved their grand historical positions by this commerce. The capital of Great Britain is now enjoying the greatest share of this traffic in consequence of her naval resources and strength. Wealth has poured in not only from her Indian possessions but from all countries of the East.

Value of Asiatic commerce.

"But this golden tide is already turning toward our Pacific slope. A single steamer in May last brought over five thousand packages of tea, a thousand bales of hemp, seven hundred bags of rice, for San Francisco; eight hundred and fifty packages of tea, and three hundred of silk for New York; eight hundred and eighty packages of tea for Chicago, etc., etc.; while the *July* steamer of the same Pacific Mail

The tide turning.

Company brought to San Francisco from China the *most valuable cargo ever landed in the United States* from any quarter of the globe, valued at two and a half millions of dollars! And this is but the beginning; the statistics of coming years will no doubt astonish the most credulous. They are but the first drops of the showers of financial prosperity which our republic, from her western border, seems destined to receive. American flour, lumber, provisions, tools, furniture, etc., now called for and used in Australia and other Pacific islands, already indicate some of the exports for which the Asiatic dwellers of the Old World are looking to the New. With American ship-building revived and flourishing, our flag will be foremost in the waters of the Pacific, not by the bloody triumphs of war, but by the peaceful victories of *commerce;* and then shall we, as a nation, realize the famous, but truthful saying of Raleigh:

Demand for American manufactures in the East.

"'Those who command the sea, command the *trade* of the world; those who command the trade of the world, command the *riches* of the world, and thus command *the world itself!*'"

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